No. 2013-1496

IN THE
United States Court of Appeals
FOR THE FEDERAL CIRCUIT

GOLDEN BRIDGE TECHNOLOGY, INC.,
Plaintiff-Appellant,

v.

APPLE INC.,
Defendant-Appellee,

and

MOTOROLA MOBILITY, LLC,
Defendant.

APPEAL FROM THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE IN CASE NO. 10-CV-0428,
JUDGE SUE L. ROBINSON

CORRECTED
PRINCIPAL BRIEF OF PLAINTIFF-APPELLANT
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CERTIFICATE OF INTEREST

Counsel for Plaintiff-Appellant, Golden Bridge Technology, Inc., certifies the following in accordance with Federal Circuit Rule 47.4:

1. The full names of every party or amicus represented by the undersigned are:

   Golden Bridge Technology, Inc.

2. The name of the real party in interest (if the party named in the caption is not the real party in interest) represented by the undersigned is:

   None

3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party or amicus curiae represented by the undersigned are:

   None

4. The names of all law firms and the partners or associates that appeared for the party or amicus now represented by the undersigned in the trial court or agency or are expected to appear in this court are:

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ABBREVIATIONS AND CITATIONS

Parties:

GBT	Plaintiff-Appellant Golden Bridge Technology, Inc.
Apple	Defendant-Appellee Apple Inc.

Defined Terms:

'267 patent	United States Patent No. 6,574,267 and its reexamination certificate
'427 patent	United States Patent No. 7,359,427
MS	Mobile station
BS	Base station
CDMA	Code division multiple access
RACH	Random access channel
PRACH	Physical random access channel
L1 ACK	Layer one acknowledgment
3GPP	Third Generation Partnership Project
UMTS	Universal Mobile Telecommunications System
Accused Devices	Apple iPhone 3G, iPhone 3GS, iPhone 4, iPhone 4S, iPad (original), iPad 2, and (new) iPad (released March 2012)

Citations:

A_____	Citation to Addendum and Joint Appendix
Note:	Citations to patents identify column number and line number and are designated as: A___, column number:line numbers. *Example*: A0100, 17:21-26. Citations to declarations identify paragraph numbers and are designated as: A___ , ¶___. *Example*: A0200, ¶8.

Citations to deposition transcripts identify page and line number and are designated as: (A___ , page number:line numbers.)
Example: A0300, 23:24-28.

STATEMENT OF RELATED CASES

This appeal relates to a previously-adjudicated appeal before this Court, *Golden Bridge Technology, Inc. v. Nokia, Inc., et al.*, No. 2007-1215 ("*Golden Bridge I*"), in which this Court issued a decision reported at 527 F.3d 1318 on May 21, 2008.[1] The Honorable Paul R. Michel, The Honorable Pauline Newman, and the Honorable Kimberly A. Moore presided over *Golden Bridge I*.

Both *Golden Bridge I* and this appeal involve U.S. Patent No. 6,574,267. However, U.S. Patent No. 6,574,267 has undergone reexamination and the reexamination certificate issued on December 15, 2009 (the patent and reexamination certificate are collectively referred to herein as "the '267 patent"). The claims of the '267 patent at issue in this appeal all issued after the conclusion of *Golden Bridge I* and were not at issue in *Golden Bridge I*. This appeal also involves U.S. Patent No. 7,359,427 ("the '427 patent"), which is a continuation of the application that issued into the '267 patent. The '427 patent was not at issue in *Golden Bridge I*.

[1] *Golden Bridge I* was an appeal taken from a judgment entered in the United States District Court for the Eastern District of Texas, *Golden Bridge Technology, Inc. v. Nokia, Inc.*, C.A. No. 2:05cv151, 2007 WL 294176 (E.D. Tex. Jan. 29, 2007) (the "Texas Litigation"). As noted herein, the claims presented in this appeal are different from those presented in the Texas Litigation and *Golden Bridge I*. The "preamble" and "access preamble" claim terms were construed in the Texas Litigation, but the construction of those terms was not presented to or passed upon by this Court.

This appeal further relates to several actions pending in the United States District Court for the District of Delaware, which involve the '267 patent and/or the '427 patent: *Golden Bridge Technology, Inc. v. Apple, Inc., et al.*, C.A. No. 10-428-SLR (D. Del.);[2] *Golden Bridge Technology, Inc. v. Amazon.com, Inc., et al.*, C.A. No. 11-165-SLR (D. Del.); *Golden Bridge Technology, Inc. v. Dell, Inc.*, C.A. No. 12-475-SLR (D. Del.); *Golden Bridge Technology, Inc. v. Hewlett-Packard Company*, C.A. No. 12-480-SLR (D. Del.); *Golden Bridge Technology, Inc. v. HTC Corp., et al.*, C.A. No. 12-477-SLR (D. Del.); *Golden Bridge Technology, Inc. v. Huawei Technologies Co. Ltd.*, C.A. No. 12-474 SLR (D. Del.); *Golden Bridge Technology, Inc. v. LG Electronics Inc.*, C.A. No. 12-478-SLR (D. Del.); *Golden Bridge Technology, Inc. v. Motorola Mobility LLC*, C.A. No. 12-471-SLR (D. Del.); *Golden Bridge Technology, Inc. v. Pantech Corp., et al.*, C.A. No. 12-476-SLR (D. Del.); *Golden Bridge Technology, Inc. v. Research In Motion Ltd., et al.*, C.A. No. 12-479-SLR (D. Del.); *Golden Bridge Technology, Inc. v. Samsung Electronics Co. Ltd., et al.*, C.A. No. 12-483-SLR (D. Del.); *Golden Bridge Technology, Inc. v. Sierra Wireless, Inc., et al.*, C.A. No. 12-473-SLR (D. Del.); *Golden Bridge Technology, Inc. v. Sony Electronics Inc., et al.*, C.A. No. 12-481-

[2] GBT's claims against Defendant Motorola Mobility LLC have yet to be adjudicated in C.A. No. 10-428-SLR, the civil action in which the United States District Court for the District of Delaware entered the partial judgment from which the present appeal was taken.

SLR (D. Del.); *Golden Bridge Technology, Inc. v. ZTE Corp., et al.*, C.A. No. 12-482-SLR (D. Del.).

JURISDICTIONAL STATEMENT

The District Court had original jurisdiction over this case for patent infringement pursuant to 28 U.S.C. § 1338.

The District Court entered an amended judgment of non-infringement pursuant to Fed. R. Civ. P. 54(b) on July 2, 2013, that disposed of Plaintiff-Appellant Golden Bridge Technology, Inc.'s infringement claims against Defendant-Appellee Apple Inc. A Notice of Appeal was timely filed on July 3, 2013. This Court has appellate jurisdiction pursuant to 28 U.S.C. § 1295(a)(1).

THE ISSUES PRESENTED FOR REVIEW

1. Whether the District Court erred in construing the "access preamble/preamble" limitations to include a requirement that the signal be "spread before transmission."

2. Whether, with regard to its grant of summary judgment of non-infringement, the District Court erred in:

a. finding that no genuine issue of material fact existed as to whether a signature sequence of the Accused Devices is "a signal for communicating with the base station," and that the Accused Devices do not practice the "spreading an access preamble" or "spread access preamble" limitations;

b. finding, based on an erroneous claim construction, that no genuine issue of material fact existed as to infringement of the claims of the '267 and '427 patents that do not recite spreading; and

c. finding that no genuine issue of material fact existed as to whether spreading a preamble during the generation of the preamble infringes the "spreading an access preamble" or "spread access preamble" limitations.

STATEMENT OF THE CASE

On May 21, 2010, Golden Bridge Technology, Inc. ("GBT") filed its complaint asserting infringement of the '267 patent and the '427 patent, both entitled "RACH Ramp-Up Acknowledgement." A115-44; A145-69. The '267 patent first issued to GBT on June 23, 2003, and subsequently underwent reexamination. A Reexamination Certificate issued on December 15, 2009. A137-44. GBT asserts that Apple infringes claims 42-44, 50-52, and 58-60 of the '267 patent. All of the asserted claims of the '267 patent were added during the reexamination. *Id.*

The '427 patent is a continuation of the '267 patent. The '427 patent issued to GBT on April 15, 2008. A145. GBT asserts that Apple infringes claims 9, 10, 14-22, 24 and 26-28 of the '427 patent.

On March 19, 2013, the District Court held a hearing on claim construction and the parties' cross-motions for summary judgment. A109. GBT had moved for summary judgment of infringement of nearly all of the asserted claims of the '267 and '427 patents, and Apple had moved for summary judgment of invalidity and cross-moved for summary judgment of non-infringement. *See* A97; A99.

On April 9, 2013, the District Court issued separate orders on claim construction and on the cross-motions for summary judgment. A25; A58. In the claim construction order, the District Court construed the terms "access

preamble/preamble" as "a signal for communicating with the base station that is spread before transmission and that is without message data."[3] A25.

In its memorandum and order granting Apple's motion for summary judgment of non-infringement, the District Court applied its construction of "access preamble/preamble" and found that the "signal for communicating" in Apple's Accused Devices is the combination of a signature sequence with a scrambling code. A41-43. The District Court concluded that the combined codes are not "spread before transmission," and on that basis granted Apple's motion for summary judgment of non-infringement. *Id*. The District Court denied Apple's motion for summary judgment of invalidity because there are disputed issues of fact, and denied GBT's motion for summary judgment of infringement. A26-58. The District Court also issued rulings on various evidentiary motions, which rulings GBT is not presently appealing. A110.

[3] The District Court also construed the term "discrete power level" to mean "a constant distinct power level" as argued by Apple. A25. In its memorandum of decision on the summary judgment motions, the District Court found that it is undisputed that Apple's Accused Devices infringe the "discrete power level" limitation. A40-41. While GBT does not agree with the District Court's construction of the "discrete power level" limitation, because it was not essential to the judgment of non-infringement that is the subject of this appeal, GBT has not addressed the construction of that limitation in this appeal. *SanDisk Corp. v. Memorex Prods., Inc.*, 415 F.3d 1278, 1292 (Fed. Cir. 2005) (reversing summary judgment of noninfringement because of erroneous claim construction, but declining to review construction of additional claim term, because "this court reviews judgments rather than claim construction orders," and "the judgment does not depend on the choice between these disputed meanings").

On April 10, 2013, GBT moved for reconsideration of the Court's summary non-infringement decision. A110. On April 11, 2013, the District Court held a hearing on GBT's motion, and on April 25, 2013, the District Court issued a memorandum order granting reconsideration but declining to modify its grant of summary judgment of non-infringement, which supplemented the District Court's April 9, 2013 summary judgment decision. A59-64.

Because the District Court's memorandum order on GBT's reconsideration motion relied on new grounds to support its summary judgment decision, on May 9, 2013, GBT filed a motion requesting that the District Court reconsider its memorandum order on reconsideration. A111. On June 13, 2013, the District Court denied GBT's May 9 reconsideration motion. A65-66.

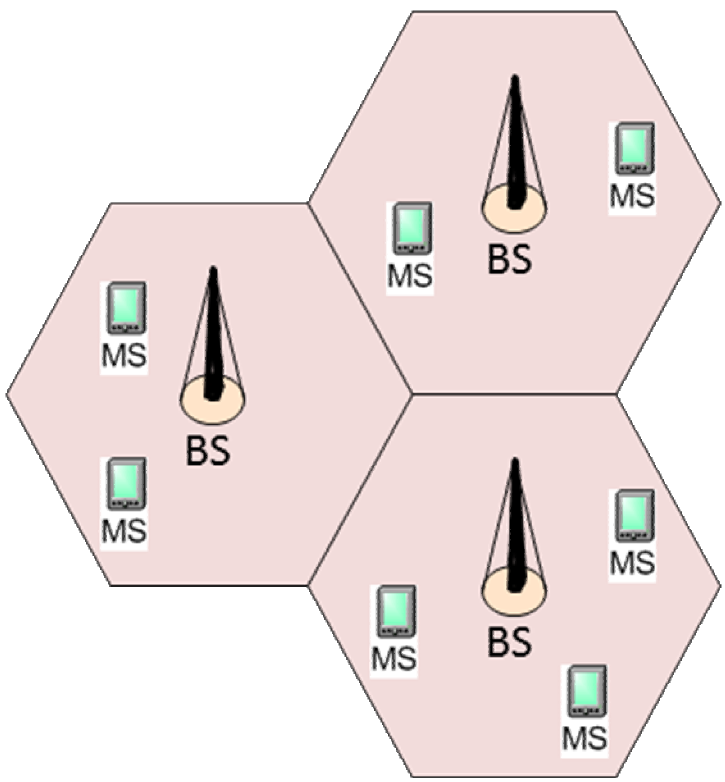
On July 2, 2013, the District Court entered an Amended Judgment pursuant to Fed. R. Civ. P. 54(b).[4] A70-72. GBT timely appealed from the Amended Judgment. A112. As set forth below, GBT submits that the District Court erred in both its claim construction and non-infringement determinations, which errors individually and collectively warrant remand.

[4] The Amended Judgment is identical to the original Judgment entered by the District Court on June 25, 2013, but includes a reference to "D.I. 320" in the THEREFORE clause. A71.

STATEMENT OF FACTS

I. OVERVIEW OF MOBILE PHONES AND THE RACH PROCEDURE

The patents-in-suit are directed to, *inter alia*, mobile stations or "MS," such as mobile phones, smartphones and tablets, and methods for connecting MS to wireless cellular networks, such as in a code division multiple access ("CDMA") wireless network. CDMA technology allows several users to transmit information over a single communication channel and share a band of frequencies. A202-03, ¶32.



An exemplary wireless cellular system is illustrated above, and includes three base station ("BS") towers and a few MS within the coverage area of each respective BS. A199, ¶20. The coverage area of each respective BS is often

referred to as a "cell." *Id*. On a per need basis, an MS can communicate over radio links with the BS in the cell to conduct a call or transmit other data. *Id*. In order to establish a communication link with a BS, each MS must send an access signal at a power level sufficient to be detected by the BS over a Random Access Channel, or "RACH." A213, ¶47; A216-17, ¶¶50-51. When an access signal at a sufficiently high power level is detected by the BS, the BS transmits an acknowledgement signal back to the MS in order to establish a communication link between the respective MS and BS. A216-17, ¶51. This procedure for establishing a communication link between a MS and BS is called a "random access" or "RACH" procedure. A213, ¶47.[5]

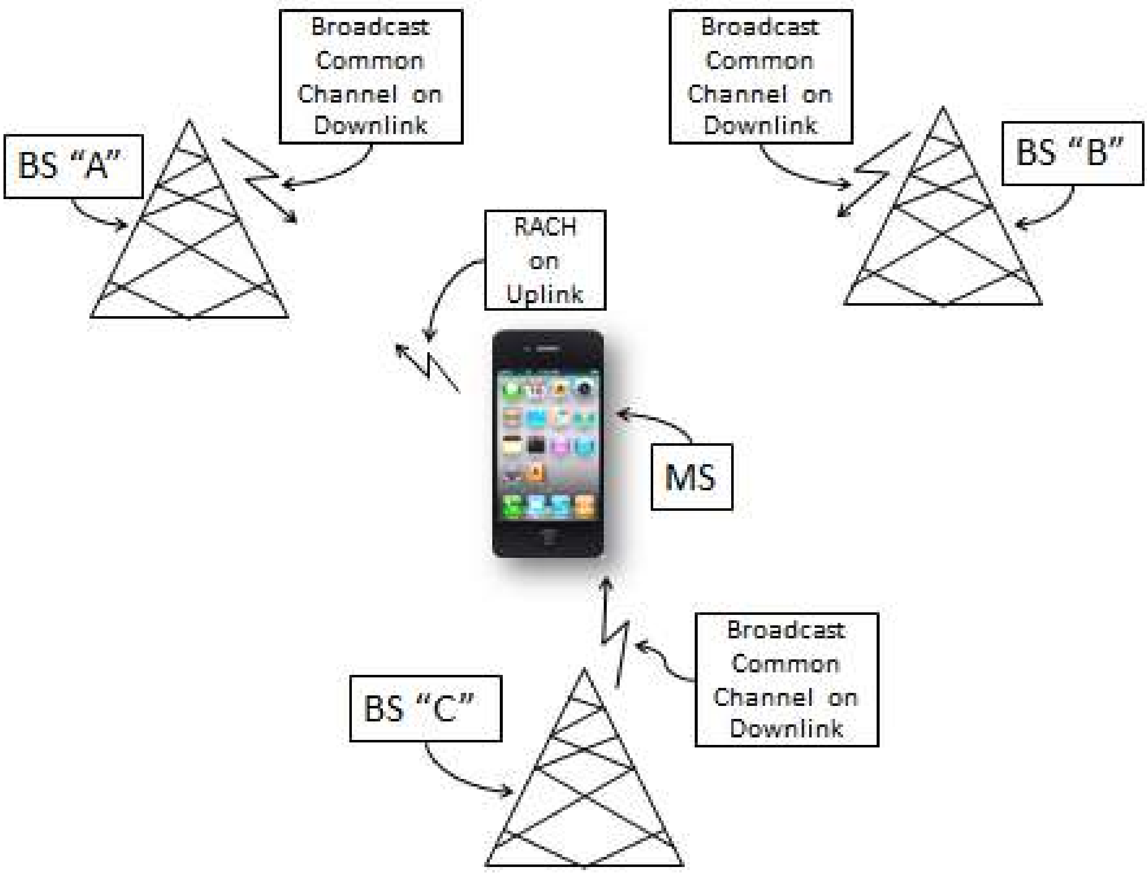
II. DEVELOPMENT OF THE INVENTION OF THE PATENTS-IN-SUIT

In early 1998, co-inventors Drs. Parsa and Kanterakis (then employees of GBT) recognized that the prior art RACH procedure was relatively slow and inefficient, so they focused on improving it and "coming up with a drastically new, faster, efficient, more capacity, higher through put access in the CDMA system[.]" A2715-16, 42:8-11, 15-18. With that goal in mind, the inventors developed a substantially faster, more efficient RACH procedure.

The invention of the patents-in-suit increased the speed for establishing a connection between a MS, such as a cell phone, and a BS. A220, ¶57. A

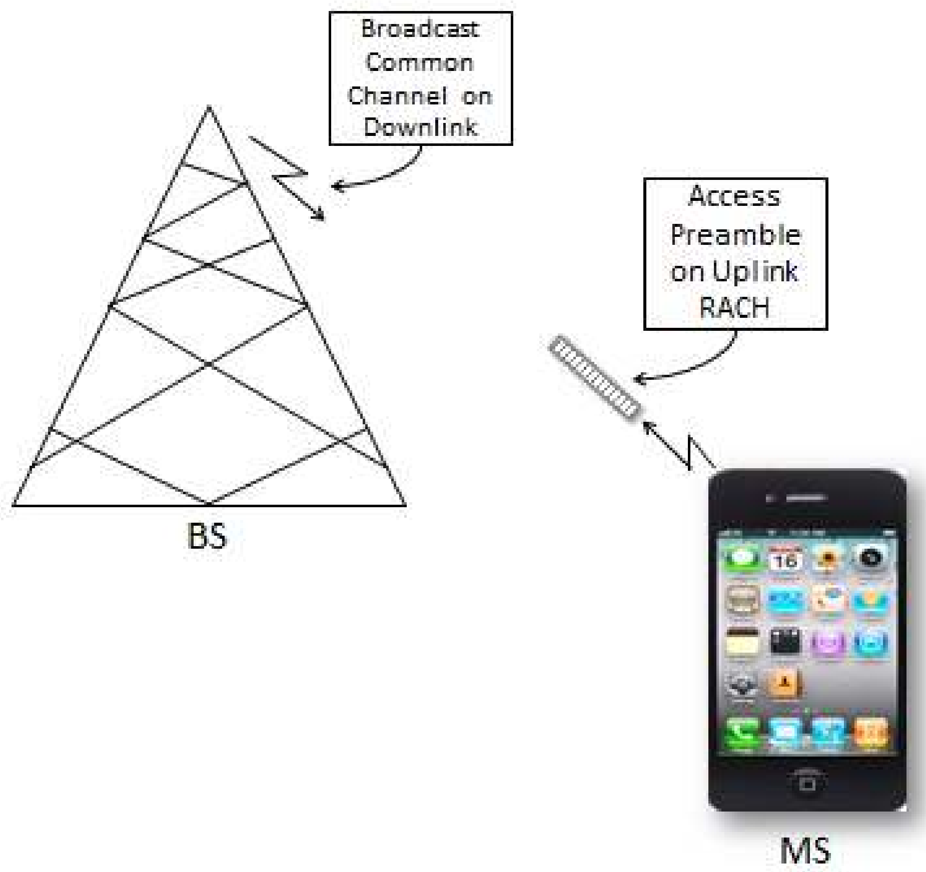
[5] A Physical Random Access Channel (PRACH) is used to carry the RACH. A3141.

rendering of FIG. 1 of the patents-in-suit is set forth below, and shows an Accused Device or MS in the vicinity of three BS, labeled BS "A," BS "B" and BS "C." *See*, *e.g.*, A117. As can be seen, each BS broadcasts (in the downlink direction) a common channel which any MS within range can detect. A220, ¶57. Each broadcast common channel contains all of the information that the MS needs to communicate with the respective BS (*e.g.*, the permissible access preambles that the MS can send to initiate the communication). *Id.*



'267 Patent – FIG. 1 Rendering

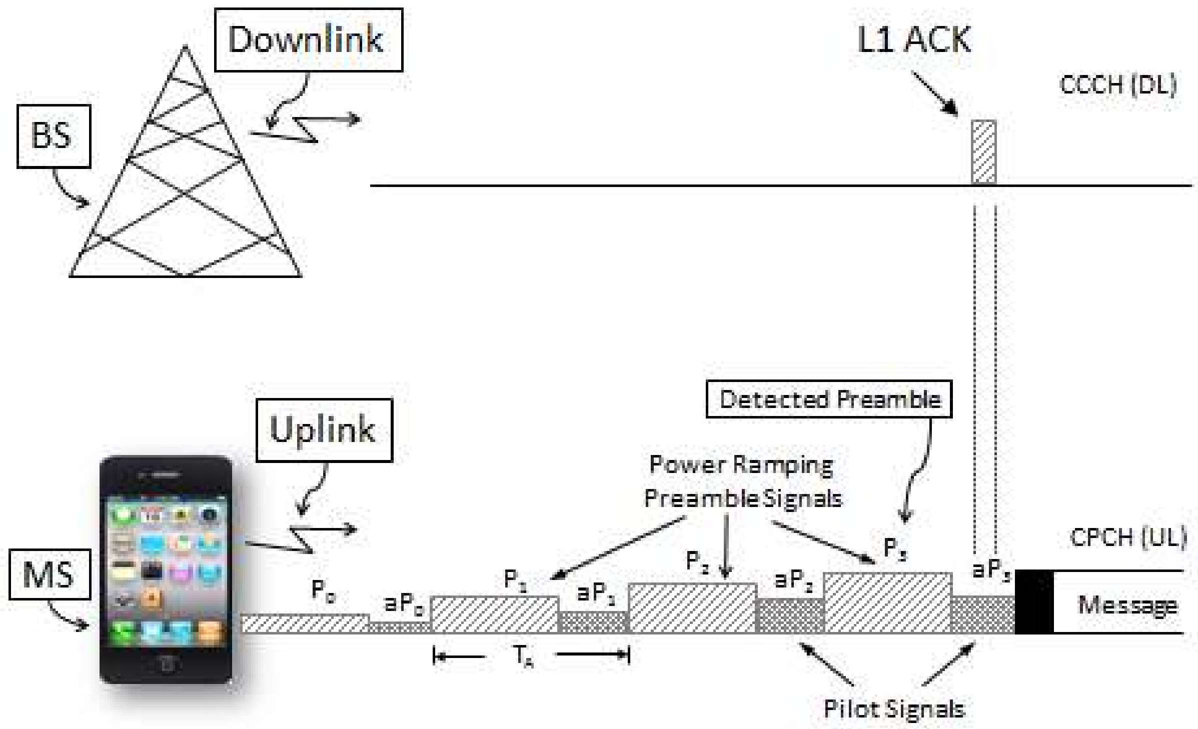
As shown in the image below, based on the parameters supplied by the broadcast common channel, the MS establishes communication with a BS by transmitting an access preamble (in the uplink direction) over a Random Access Channel (RACH). A212-17, ¶¶46-52. The access preambles do not include message data, and are transmitted at increasing, discretely different power levels. A213-14, ¶¶47-48; A216, ¶50.



MS Transmits Access Preamble to BS Over RACH

ME1 16434847v.1

The RACH procedure is illustrated in FIG. 6 of the patents-in-suit.[6] A122. A rendering of FIG. 6 with images of a BS added on the downlink (DL) and MS added on the uplink (UL) is reproduced below.



'267 Patent - FIG. 6 Rendering

As can be seen, the access preambles or "preamble signals" are transmitted at increasing, discretely different power levels, P_0, P_1, P_2 and P_3.[7] If no layer one

---

[6] As noted above, the '427 patent is a continuation of the '267 patent, and accordingly, both patents have nearly identical specifications.

[7] FIG. 6 also shows pilot signals transmitted between the preamble signals; however, the patents-in-suit disclose that the pilot signals can be eliminated by

acknowledgement ("L1 ACK") signal from the BS corresponding to an access preamble is detected by the MS within a set time following transmission of a first access preamble, then the MS transmits another access preamble at a second discrete power level P_1 higher than the first discrete power level P_0. A130, 5:59-6:10; A216, ¶50. This step is repeated until a preamble is transmitted at a sufficiently high power level to be detected by the BS, which in FIG. 6 is "P_3." *Id*. This, in turn, causes the BS to transmit on the downlink an "L1 ACK," which is shown in FIG. 6 immediately following the "detected preamble." A216-17, ¶51. When an L1 ACK corresponding to a transmitted access preamble is detected by the MS, it ceases preamble transmission and transmits on the uplink to the BS packet data or, as shown in FIG. 6, a "Message" immediately following the L1 ACK. A216-17, ¶¶51-52.

The prior art "IS-95" system was commercially implemented at the time of the development of the invention of the patents-in-suit. A199, ¶28. The IS-95 system transmitted access probes comprising both a preamble and message data, which meant a much longer access probe, and required a higher level acknowledgement indicating that the message data portion of the access probe was received and processed. *See, e.g.*, A1661. As a result, the prior art was sluggish and inefficient. A2717, 254:14-255:6.

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setting their power levels to zero so that there are wait periods between the preambles. A131, 7:55-57.

One innovative aspect of the invention of the patents-in-suit was transmitting access preambles at increasing, discretely different power levels, and without message data. This significantly reduced the length of the signal and the time required to send an access request to the BS. A213-14, ¶48; A220, ¶57. Another innovative aspect was the use of a layer one acknowledgement (or "L1 ACK") to acknowledge the detection of a preamble. A131, 7:58-66; A216-17, ¶51. Because the access preamble was a relatively short duration signal without message data, it could be processed at the BS and the resulting connection established quickly. A213-14, ¶48; A220, ¶57. Further, the L1 ACK was processed and transmitted at layer one, and therefore could be processed and transmitted more quickly than if sent from a higher layer. A216-17, ¶51; A220, ¶57.

Representative claim 42 of the '267 patent claims the RACH procedure of the invention and recites "A method of transferring packet data for a mobile station (MS) with an MS receiver and an MS transmitter, comprising:"

> receiving at the MS receiver a broadcast common channel from a base station;
>
> determining a plurality of parameters required for transmission to the base station;
>
> spreading an access preamble selected from a set of pre-defined preambles;

> transmitting from the MS transmitter the spread access preamble, at a first discrete power level;
>
> if no layer one acknowledgement corresponding to the access preamble is detected, transmitting a spread access preamble from the MS transmitter at a second discrete power level higher than the first discrete power level; and
>
> upon detecting a layer one acknowledgment corresponding to a transmitted access preamble, ceasing preamble transmission and transmitting the packet data from the MS transmitter.

A141, 4:8-29.

III. THE 3GPP W-CDMA/UMTS STANDARD INCORPORATES THE CLAIMED INVENTION

GBT was founded in 1995 and was engaged in the development of wideband code division multiple access (W-CDMA) systems. A184-85. During the late 1990's and early 2000's, GBT developed wireless telecommunication hardware and improved operating methodologies for W-CDMA systems. *Id*. As a result of these efforts and GBT's investment, GBT is the owner of numerous patents related to W-CDMA technology. A185.

In early 1998, GBT became involved in efforts to develop the third-generation ("3G") wireless standard through its participation on the TR 46.1 Committee organized through the Telecommunications Industry Association. A186. Other committee participants included AT&T Laboratories, Ericsson, Lucent Technologies and Nokia. *Id*. Dr. Parsa, a co-inventor of the patents-in-suit

and GBT employee, was a key participant in this project, and served as chairman of a subcommittee. A2743. GBT was instrumental in developing portions of what the Third Generation Partnership Project ("3GPP") ultimately promulgated as its 3G W-CDMA/UMTS Standard, which requires the invention of the patents-in-suit. The 3GPP Standard incorporates the RACH procedure developed by GBT and covered by the patents-in-suit. A222, ¶¶63-65; *see also, e.g.*, A293-304.

IV. THE ACCUSED DEVICES COMPLY WITH THE 3GPP STANDARD AND PRACTICE THE INVENTIONS OF THE PATENTS-IN-SUIT

GBT accuses the Apple iPhone 3G, iPhone 3GS, iPhone 4, iPhone 4S, iPad (original), iPad 2, and (new) iPad (released March 2012) (collectively, the "Accused Devices") of infringing the patents-in-suit. A28; A221, ¶62. The Accused Devices all establish communication with a BS in compliance with the 3GPP Standard and the RACH process described above. A222, ¶¶62-65; *see also, e.g.*, A293-304.

A. The Access Preambles of the Accused Devices Are Signature Sequences, and Each Signature Sequence Is a Signal for Communicating with the Base Station That Is Without Message Data.

As indicated in "Table 3" below, 3GPP TS 25.213 Section 4.3.3.3 provides 16 available signatures, "$P_0(n)$" through "$P_{15}(n)$." A822-23. The Accused Devices each generate an access preamble by randomly selecting one access preamble signature from this set of 16 available signatures. A213-14, ¶48, A749, ¶9. Each

signature is 16 chips in length and each chip is a very short, discrete impulse of energy. A749-50, ¶9, 11. As shown in Table 3, a positive discrete impulse is mathematically represented by a +1 and a negative discrete impulse is mathematically represented by a -1. A749-50, ¶11. Thus, each signature has a unique pattern of 16 discrete impulses ("0" through "15" in the upper row of Table 3) that can be recognized by a BS. *Id*.

Table 3: Preamble signatures

Preamble signature	Value of *n*															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
$P_0(n)$	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
$P_1(n)$	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1
$P_2(n)$	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1
$P_3(n)$	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1
$P_4(n)$	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1
$P_5(n)$	1	-1	1	-1	-1	1	-1	1	1	-1	1	-1	-1	1	-1	1
$P_6(n)$	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1
$P_7(n)$	1	-1	-1	1	-1	1	1	-1	1	-1	-1	1	-1	1	1	-1
$P_8(n)$	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1
$P_9(n)$	1	-1	1	-1	1	-1	1	-1	-1	1	-1	1	-1	1	-1	1
$P_{10}(n)$	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1
$P_{11}(n)$	1	-1	-1	1	1	-1	-1	1	-1	1	1	-1	-1	1	1	-1
$P_{12}(n)$	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1
$P_{13}(n)$	1	-1	1	-1	-1	1	-1	1	-1	1	-1	1	1	-1	1	-1
$P_{14}(n)$	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1
$P_{15}(n)$	1	-1	-1	1	-1	1	1	-1	-1	1	1	-1	1	-1	-1	1

3GPP TS 25.213, Section 4.3.3.3 Table 3

Each access preamble is generated by repeating the randomly selected preamble signature 256 times to obtain a signature sequence of 4096 chips. A213-14, ¶48, A748, ¶4; A749, ¶9. Each access preamble consists of a sequence of chips corresponding to the repeated, randomly selected signature, and is without message data. A213-14, ¶48. The image below shows an exemplary signature sequence corresponding to signature "3." As can be seen, signature 3 ("P_3(n)") from Table 3

above was selected and repeated 256 times to generate a signature sequence of 4,096 chips (i.e., 256 x 16 chips for each repeated signature 3). This signature sequence is the access preamble corresponding to signature 3 before spreading. A213-14, ¶48; A748, ¶4; A749, ¶9.

$P_3(n)$	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1
$P_3(n)$	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1
$P_3(n)$	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1
$P_3(n)$	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1
$P_3(n)$	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1
$P_3(n)$	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1
$P_3(n)$	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1
$P_3(n)$	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1
								⋮								
$P_3(n)$	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1

16 chips X 256 = 4,096 chips

Randomly Selected Signature 3 Is Repeated 256 Times To Generate A Signature Sequence of 4096 Chips, Which Is The Access Preamble Corresponding to Signature 3 Before Spreading

The signature sequences (or access preambles) are digital signals for communicating with the BS. A225-26, ¶74; A749, ¶9. Each signature sequence communicates to the BS information that (i) notifies the BS that the Accused

Device is initiating a random access procedure, identifies the Accused Device, and distinguishes it from other MS that are simultaneously transmitting preambles, and (ii) is necessary for the BS to respond to the Accused Device with an L1 ACK corresponding to the last transmitted preamble and start a communication link between the Accused Device and BS. A213-14, ¶48; A216-17, ¶51; A225-26, ¶74.

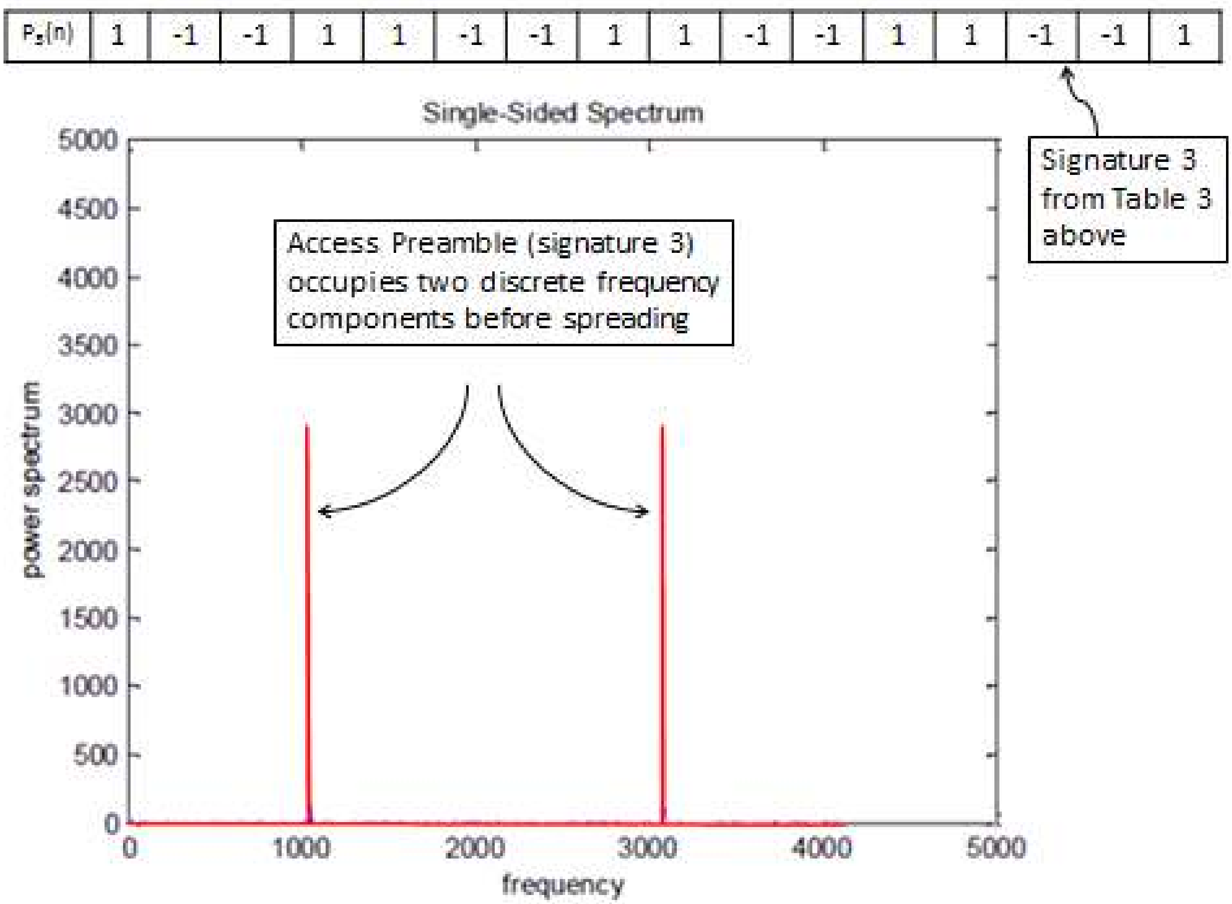
B. Each Access Preamble of the Accused Devices Is Spread Before Transmission to a Base Station.

Prior to transmission, each access preamble is spread by a scrambling code available for the RACH procedure for the respective BS. A213-14, ¶48. The term "bandwidth" is commonly understood by those skilled in the art to mean "the range of frequencies occupied by a signal." A201, ¶31. This definition is recited in several dictionaries. A750-52, ¶¶13-22; A769-70. When each access preamble is spread by the scrambling code, this increases the range of frequencies occupied by the access preamble, and thus increases the bandwidth of the access preamble. A213-17, ¶¶47-52; A438-54.

GBT's expert, Dr. Vojcic, produced power spectra illustrating the frequencies occupied by each access preamble of the Accused Devices before and after spreading by the respective scrambling code. A438-54. Dr. Vojcic's power spectra illustrate the spreading of the access preamble by the scrambling code just as described in the 3GPP Standard and implemented in the Accused Devices which comply with the Standard. A438. The preamble signatures are from Table 3 in

Section 4.3.3.3, the scrambling code per Section 4.3.2.2, and the signature and scrambling codes are implemented according to Sections 4.3.2.2 and 4.3.3.1-3, all of TS 25.213 v.6.0. *Id*.; A819-23. In each instance, the access preamble before spreading by the scrambling code occupies only one or more discrete frequency component(s). A439-54. Then, after spreading by the scrambling code, each access preamble occupies the full range of frequencies. A214-16, ¶¶49-50; A439-54. Thus, spreading of the access preambles by the scrambling codes increases their bandwidths.

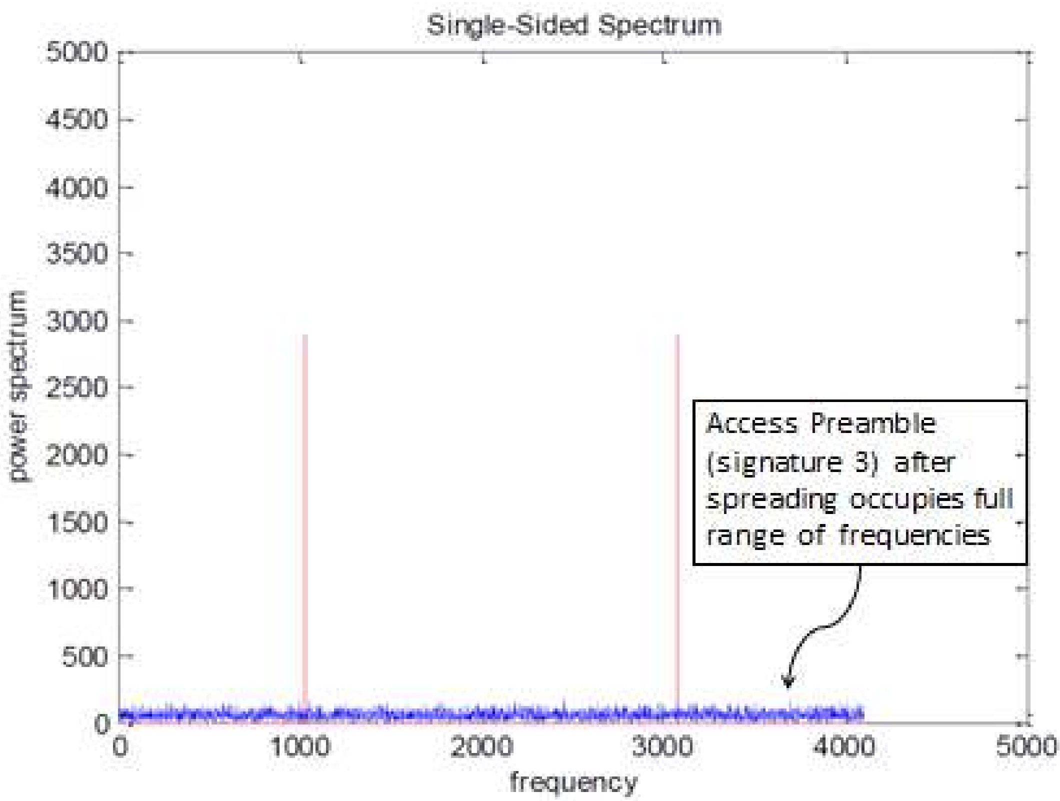
An exemplary power spectrum graph produced by Dr. Vojcic for an access preamble corresponding to signature 3 before spreading is reproduced below. A441. As shown, signature 3 is 16 chips long, each chip is a very short, discrete impulse of energy, where each positive discrete impulse is represented by a +1 and each negative discrete impulse is represented by a -1. A749-50, ¶¶9, 11. Thus, signature 3 has a unique pattern of discrete impulses that can be recognized by a BS. A213-14, ¶48. As indicated above, the access preamble corresponding to signature 3 is the selected signature repeated 256 times to obtain a signature sequence of 4096 chips.



Power Spectrum of Access Preamble Corresponding to Signature 3, Before Spreading by Scrambling Code

As shown above, the vertical axis indicates the magnitude of the power spectrum, and the horizontal axis indicates the frequencies occupied by the access preamble signal. A214-16, ¶49; A226, ¶76. The vertical red lines are the spectral components of the power spectrum of the access preamble. *Id*. The magnitudes of the access preamble power spectrum are indicated by the heights of the vertical red lines. *Id*. The frequencies occupied by the signal are indicated by the positions of the vertical red lines on the x-axis, i.e., the frequency axis. *Id*. As can be seen, the

access preamble corresponding to signature 3 occupies only two discrete frequency components where the respective vertical red lines are located, i.e., at about 1000 and about 3000 on the frequency scale. *Id*. The horizontal red line in each graph extends adjacent to or between the vertical red lines. Each horizontal red line is at zero, and therefore indicates that the access preamble does not occupy the frequencies extending between or otherwise outside of the vertical red lines. A438-54.



Power Spectrum of Access Preamble Corresponding to Signature 3, After Spreading by Scrambling Code

An exemplary power spectrum graph for the access preamble corresponding to signature 3 after spreading by the scrambling code is reproduced above. A441. The blue curve shows the power spectrum of the access preamble corresponding to signature 3 after spreading by the scrambling code. *Id*.; A214-16, ¶49; A226, ¶76. As can be seen, the blue curve occupies the full range of frequencies. Thus, GBT's evidence demonstrates that before spreading, this access preamble of the Accused Devices occupies only two discrete frequency components. A214-16, ¶49. Then, after spreading by the scrambling code, the access preamble occupies the full range of frequencies. *Id*.; A438-54. Thus, spreading of the access preamble by the scrambling code necessarily increases its bandwidth.

Although the power spectra of only the access preamble corresponding to signature 3 are reproduced above, Dr. Vojcic produced as Exhibit C to his Expert Report similar power spectra for the access preambles corresponding to all 16 signatures available to the Accused Devices. A438-54. In each case, spreading the access preamble by the scrambling code increases the range of frequencies occupied by the signal, and thus increases their bandwidths. *Id*.

C. GBT's Testing of the Accused Devices.

While compliance with the 3GPP Standard necessarily results in infringement of the asserted claims, GBT nevertheless tested the Accused Devices to further confirm they infringe. A471-76, ¶¶38-49. The testing, performed at an

accredited laboratory, confirmed that the Accused Devices meet the following limitations of the asserted claims (A464-65, ¶¶15-19):

1) Following receipt of the broadcast common channel, the Accused Devices transmit an access preamble at a first discrete power level to the BS (A483-84, ¶¶65-66);

2) If the Accused Devices receive an L1 ACK in response to the transmitted Access Preamble, they send message data to the BS (A491-96, ¶¶86-96);

3) If, after a set time, the Accused Devices do not receive an L1 ACK in response to the transmitted access preamble, they transmit a second access preamble at a discretely different, higher power level (A485-91, ¶¶71-84);

4) The Accused Devices repeat step 3 until either (a) an L1 ACK is received in response to a transmitted access preamble (as depicted in FIG. 6 of the patents-in-suit, *supra*, p. 10), or (b) a maximum number of preamble transmissions are made without response, in which case the Accused Devices cease preamble transmissions until a later time. *Id*.

Apple has not introduced any evidence to controvert either Dr. Vojcic's power spectra showing that each access preamble is spread by the scrambling code, or the results of the testing performed by GBT.

SUMMARY OF ARGUMENT

1. The District Court erred in construing the "access preamble/preamble" limitation (collectively referred to herein as the "preamble" limitation) to the extent that it introduced into the "preamble" the additional requirement that it be "spread before transmission." There is no legally permissible basis to read "spread before transmission" into the "preamble" limitation. "Spreading" is explicitly recited as a limitation in many of the claims, and therefore the introduction of this limitation into the "preamble" renders the "spreading" limitation superfluous and introduces ambiguity. The intrinsic record treats the "preamble" and "spreading" limitations as separate and distinct terms. The specification neither defines "preamble" to mean a signal "that is spread before transmission," nor limits the term to a particular embodiment. Any statements about "spreading" in the file history apply only to those claims that explicitly recite "spreading."

2. There are disputed issues of fact as to whether the signature sequence of the Accused Devices is a "signal for communicating with the base station" that preclude summary judgment of non-infringement. GBT's experts have provided significant evidence proving that each signature sequence communicates to the BS information that (i) notifies the BS that the Accused Device is initiating a random access procedure, identifies the Accused Device, and distinguishes it from other MS that are simultaneously transmitting preambles, and (ii) is necessary for the BS

to respond to the Accused Device with an L1 ACK corresponding to the last transmitted preamble and start a communication link between the Accused Device and BS. This evidence must be viewed in the light most favorable to, and by drawing all reasonable inferences in favor of, GBT. When this is done, there are, at the very least, disputed issues of fact that preclude summary judgment of non-infringement.

3. The District Court erred in finding that the signature sequence must be combined with the scrambling code to be a "signal for communicating with the base station." The Accused Devices transmit the spread access preamble on the physical random access channel or "PRACH." The 3GPP Standard refers to the combined signature sequence and scrambling code that is transmitted on the PRACH as the "PRACH preamble." Rather than read the claimed "preamble" on the signature sequence, the District Court conflated the "PRACH preamble" referenced in the 3GPP Standard with the claimed "preamble," and erroneously found that the signature sequence is not the claimed preamble because it is not the PRACH preamble.

4. The District Court further erred by finding that the claimed "preamble" required the combination of the signature sequence and scrambling code in order to meet the "signal for communicating with the base station" aspect of the claim construction. Instead of simply requiring "a signal for communicating with the

base station," the District Court required the signal to include additional processing performed by the Accused Devices, such as spreading the signature sequence with the scrambling code, in order to transmit the signal to the BS. The District Court further erred by finding that the scrambling code is necessary for the signature sequence to communicate with the BS. Not only is this finding unnecessary for infringement, but it is wrong because the scrambling code does not perform the communicating function. Rather, the spread access preamble must be de-spread at the BS in order to remove the scrambling code and, in turn, allow the underlying signature sequence to communicate with the BS. The District Court further erred because its application of the claims in finding non-infringement excludes a preferred embodiment.

5. Claims 50 and 58 of the '267 patent and claims 9-10, 14, 15, 17-19, 21-22, 24 and 26-28 of the '427 patent do not recite "spreading," and therefore if this Court reverses on claim construction, and determines that the "preamble" limitation does not include a "spread before transmission" limitation, the case must be remanded for findings as to whether these claims are infringed in light of the fact that Apple has conceded that the PRACH Preamble (the combination of the signature sequence and the scrambling code) is "a signal for communicating with the base station."

6. If this Court finds that the signature sequence is not a claimed "preamble" until combined with the scrambling code and that there are no material facts in dispute on this issue (which would not be correct for the reasons summarized above), the Accused Devices nevertheless infringe because the claims cover spreading when generating the preamble, and therefore this case would need to be remanded for further infringement proceedings.

ARGUMENT

I. CLAIM CONSTRUCTION

A. Legal Principles and Standard of Review.

Claim construction is a matter of law that this Court reviews *de novo*. *In re Gabapentin Patent Litig.*, 503 F.3d 1254, 1259 (Fed. Cir. 2007) (citing *Cybor Corp. v. FAS Techs., Inc.*, 138 F.3d 1448, 1456 (Fed. Cir. 1998) (en banc)). Claim terms have the meaning that they would have to a person of ordinary skill in the art. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). In construing the claims, they "'must be read in view of the specification, of which they are a part.'" *Id.* at 1315 (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc)). The Court must consider the prosecution history of the patent before the PTO. *Id.* at 1317. Where the patent has undergone reexamination, a reexamination proceeding is part of the prosecution history, and also must be considered. *See On Demand Mach. Corp. v. Ingram Indus., Inc.*, 442 F.3d 1331, 1338-39 (Fed. Cir. 2006). It is inappropriate to inject limitations into claim terms without a legally permissible basis to do so. *See Arlington Indus., Inc. v. Bridgeport Fittings, Inc.*, 632 F.3d 1246, 1255-1256 (Fed. Cir. 2011) (reversing claim construction that introduced additional limitation into claim term, because "[r]eview of the intrinsic evidence reveals no intent to limit the term 'spring metal adaptor' by using it in a manner that excludes unsplit adaptors"); *Liebel–Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 906 (Fed. Cir.

2004) ("the claims of the patent will not be read restrictively unless the patentee has demonstrated a clear intention to limit the claim scope").

B. The District Court Impermissibly Added "Spreading" to the "Preamble" Limitation.

The District Court construed the "preamble" limitation as "a signal for communicating with the base station <u>that is spread before transmission</u> and that is without message data." A19 (emphasis added). This construction is legally incorrect to the extent that it injects into the "preamble" limitation the requirement that it be "spread before transmission." There is no basis to conclude that persons of ordinary skill in the art would understand the "preamble" limitation – when read in light of the specification and prosecution history – to require that it be "spread before transmission."[8]

1. The Intrinsic Record Treats "Preamble" and "Spreading" As Separate and Distinct Terms.

The specification and file history make clear that the inventors understood and treated the "preamble" and "spreading" limitations as separate and distinct terms, and that when they intended to describe "spreading" the "preamble" they explicitly stated so. *See, e.g.*, A1163-72. *See Bell Atl. Network Servs., Inc. v.*

[8] In an effort to simplify and narrow the claim construction issues in dispute, GBT appeals only the "spread before transmission" aspect of the District Court's construction of the "preamble" limitation. *See Jang v. Boston Scientific Corp.*, 493 F. App'x 70, 75-76 (Fed. Cir. 2012) (recognizing appellant's ability to narrow disputed claim construction issues for purposes of appeal). A3185-92.

Covad Commc'ns Grp., Inc., 262 F.3d 1258, 1270-73 (Fed. Cir. 2001) (relying on patentee's "consistent use" in specification to determine that terms "rate" and "mode" referred to "two separate and distinct concepts"). Most of the asserted claims explicitly recite "spreading an access preamble," "spread access preamble," or "spreading the selected preamble code."[9] If the inventors meant for the term "preamble" to inherently mean "spread before transmission," they would not have explicitly recited in some (but not all) claims that the "preamble" is "spread" before transmission.

Indeed, throughout this litigation the parties have treated the terms "preamble" and "spreading" as separate limitations. The parties stipulated that "spreading" means "increasing the bandwidth" of the preamble. A2744. The parties treated "preamble," on the other hand, as a different limitation, did not stipulate to a construction of this limitation, and submitted this limitation for construction by the District Court. A2745. There is no legally permissible reason to read "spread before transmission" into the "preamble" limitation. *See Fuji Photo Film Co., Ltd. v. Int'l Trade Comm'n*, 386 F.3d 1095, 1104-05 (Fed. Cir. 2004) (Commission erred in reading "in a darkroom" limitation into method steps where it was not recited).

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[9] *See* '267 patent claims 42-44, 51-52 and 59-60, and '427 patent claims 16 and 20 A141-44; A166-67.

2. The Specification Neither Defines "Preamble" To Inherently Mean "Spread Before Transmission," nor Limits the Term to a Particular Embodiment.

Although the District Court acknowledged that "claim language is not necessarily limited to a particular embodiment," it nevertheless improperly read the "spreading" limitation from a preferred embodiment into the "preamble" limitation despite no clear intention by the patentee to do so. A11-15; A19. This is particularly inappropriate where, as here, that embodiment is not the only embodiment described in the specification. *Dealertrack, Inc. v. Huber*, 674 F.3d 1315, 1327 (Fed. Cir. 2012) ("As a general rule, 'it is improper to read limitations from a preferred embodiment described in the specification--even if it is the only embodiment--into the claims absent a clear indication in the intrinsic record that the patentee intended the claims to be so limited.'") (citation omitted); *MySpace, Inc. v. GraphOn Corp.*, 672 F.3d 1250, 1255 (Fed. Cir. 2012) (improper to read limitations from written description into claim limitation absent clear intention by patentee to do so).

The District Court construed the "preamble" limitation to include a "spreading" requirement based upon the description of the embodiment of FIG. 4, stating that "the specification is largely directed to a detailed description of the figures; it does not contemplate any other embodiment regarding generating and transmitting a preamble." A12. This is not correct.

The embodiment shown in FIG. 4 is simply "a block diagram of a mobile station receiver and transmitter …." A128, 2:25-26. There is no indication, much less words of exclusion or restriction, that the invention is limited to FIG. 4, or that the mobile station and receiver could not take other forms. Rather, the specification describes FIG. 4 as merely an "illustrative embodiment." A129, 4:17. Based on the unremarkable description of FIG. 4, the District Court erroneously concluded that the specification "does not contemplate any other embodiment regarding generating and transmitting a preamble." A12. However, in stark contrast to the District Court's conclusion, the specification provides elsewhere -- under the heading "The Preamble Signal Structure" – a detailed disclosure in connection with FIGS. 8(a) and 8(b) for generating preambles. A131, 8:13-40. That disclosure is unambiguously clear that the claimed preamble is not limited to any particular embodiment, but rather may take any of numerous different forms. *Id*., 8:15 ("There is a large set of possible preamble waveforms."); *Id*., 8:19-20 ("There are many ways of generating preamble waveforms."); *see also id*., 7:19-22 ("The particular structure of the preamble waveforms is selected on the basis that detection of the preamble waveform at the base station is to be as easy as possible with minimal loss in detectability.").

Accordingly, the specification makes clear that the patentee did not intend to limit the generation or form of the preamble to any particular disclosed

embodiment. *See Liebel-Flarsheim*, 358 F.3d at 906 (claims will not be restricted to preferred embodiments "unless the patentee has demonstrated a clear intention to limit the claim scope using 'words or expressions of manifest exclusion or restriction.'") (citation omitted).

3. The File History Does Not Define the "Preamble" Limitation Itself To Require That It Be "Spread Before Transmission," nor Does It Disavow Preambles That Are Not Spread.

There is nothing in the prosecution history to support the District Court's determination that all claimed "preambles" are "spread." There is not a single office action, response, or the like in which either the patentee or the examiner expressly stated that the "preamble" limitation itself required "spreading." Wherever the prosecution history references "spreading," it is clear that the discussion pertains only to claims that explicitly recite "spreading." *See Golight, Inc. v. Wal-Mart Stores, Inc.*, 355 F.3d 1327, 1333 (Fed. Cir. 2004) ("[S]tatements about [the prior art's] inability to rotate through 360° were made to distinguish only those claims that explicitly recited a 360° limitation.").

The District Court erroneously determined that certain statements in the file history support the construction reading "spread before transmission" into the "preamble" limitation. First, the District Court relied on the following statement made by the patentee in response to the examiner's rejection of certain claims:

> Another disclosed distinction is that the access preamble here is itself a form of code data (e.g., a signature) **that is spread** in essentially the same manner as other data.

A14 (emphasis in original) quoting A1167. But when this statement is viewed in context, it is clear that the patentee made the argument that the access preamble or signature "is spread" only with respect to those claims that explicitly recite "spreading." A1163-72. This statement appears in the midst of the patentee's remarks concerning pending claims 43-49.[10] *Id*. In the paragraph where the quoted statement appears, the patentee did not cite to any claims. *Id*. However, in the paragraph immediately following the quoted statement, the patentee was clear that the statement applied only to those claims that explicitly recite the specific distinctions identified. *Id*. Further, the patentee explained that the paragraphs that follow address more specifically how the different groups of claims 43-49 distinguish over the prior art:

> The modifications proposed in the obviousness rejections do not address any of these distinctions. It is respectfully submitted that each of **<u>claims 43-49 now specify one or more of these distinctions</u>**. **<u>The language of these claims and the specific differences over Ozluturk are discussed below</u>**.

A1168 (emphasis added).

In discussing the different groups of claims 43-49, and how they distinguish over the prior art, the patentee only argued that the claims at issue that explicitly

[10] These claims issued in the '267 patent as claims 23-29. A135-36.

recite "spreading" distinguish over the prior art because of this limitation (claims 47-49). A1167-69. For the group of claims at issue that did not recite "spreading" (claims 43-46), the patentee made no mention of "spreading," but rather argued that these claims distinguished over the prior art for different reasons. A1168; *see also* A1101-04.

Specifically, claims 43-46 each recited transmitting a "preamble," but did <u>not</u> recite "spreading" the preamble before transmission. A1096-98. Accordingly, the patentee did not mention "spreading" in connection with claims 43-46, much less argue they distinguished over the prior art based on "spreading." (*Id*.; A1101-04; A1168-69. Rather, the patentee argued that claims 43-46 distinguished over the prior art based on the transmission of preambles at a "first power level" and a "second power level" with "some delay separating preamble transmissions." A1101-04; A1168.

Claims 47-49, on the other hand, explicitly recited "spreading an access preamble." A1171-72. Accordingly, the patentee argued that these claims, and only these claims, distinguished over the prior art because they recited "spreading an access preamble":

> Claims 47 and 49 have been amended to more clearly point out certain distinctions over the art. Specifically, claims 47 and 49 expressly require that the power levels of the preamble transmissions are discretely different. <u>**These amended independent claims also require**</u> that the mobile transmission involves a <u>**spreading**</u> of <u>**an access preamble**</u>. As

> noted, Ozluturk uses a continuous ramp-up instead of discrete power levels. Also, the short code and the access code used by Ozluturk do not spread or carry any type of preamble (or any other form of data). Hence, **Ozluturk** also **does not spread** an **"access preamble"** as required by claims 47 and 49.

A1169. It is clear that the patentee argued that only the claims that recite "spreading" distinguish over the prior art based on "spreading," and that the patentee did not intend for the "preamble" limitation in any way to inherently mean "spread before transmission." *See Golight*, 355 F.3d at 1333 ("[S]tatements about [the prior art's] inability to rotate through 360º were made to distinguish only those claims that explicitly recited a 360º limitation."); *see also Intervet Am. v. Kee-Vet Labs., Inc.*, 887 F.2d 1050, 1053-54 (Fed. Cir. 1989) ("single administration" term added to three claims by amendment could not be read into other claims that were not amended to include term based on erroneous statement by patentee).

The District Court erroneously concluded that because the patentee amended claims 47 and 49 to expressly recite "spreading," and stated that such amendment was "to more clearly point out certain distinctions over the prior art," that this somehow "indicates that, even prior to amendment, the patentee contemplated a preamble to be spread prior to transmission." A15. The patentee would not have explicitly amended claims 47 and 49 to recite "spreading," and point out how such amendment distinguishes over the prior art, if the amendment were meaningless and the term "preamble" already included the "spreading" limitation. The District

Court's conclusion defies logic and is legally erroneous.[11] *Jansen v. Rexall Sundown, Inc.*, 342 F.3d 1329, 1334 (Fed. Cir. 2003) (terms added by amendment to secure allowance must be given weight because "the patentability of the claim hinged upon their presence in the claim language."). *See also Bicon, Inc. v. Straumann Co.*, 441 F.3d 945, 950 (Fed. Cir. 2006) ("[C]laims are interpreted with an eye toward giving effect to all terms in the claim.").

4. The District Court's Construction of "Preamble" Is Also Legally Erroneous Because It Would Render the "Spreading" Limitation Superfluous and Introduce Ambiguity.

The District Court's construction improperly introduces a second level of spreading into the claims which recite a "spreading" limitation, or it renders the "spreading" limitation in those claims superfluous. Under the District Court's construction, the claims that recite "spreading an access preamble," such as, for example, claim 42 of the '267 patent, must be read to recite "<u>spreading</u> [a signal for communicating with the base station <u>that is spread</u> ….]."[12] A19; A141, 4:8-29. Accordingly, this construction, when read in the context of the surrounding claim language, either (1) could be argued to require that the "spreading" occur twice (i.e., "<u>spreading</u> a signal … that is <u>spread</u> …"), or (2) renders the term "spreading"

[11] Notably, at least one other claim reciting the claimed "preamble" had already been allowed by the examiner without requiring that the preamble be spread (originally proposed claim 38, which issued as '267 patent claim 18). A135.
[12] Claims 42-44, 51-52 and 59-60 of the '267 patent, and claims 16 and 20 of the '427 patent each recite a "spreading" limitation. A141-44; A166-67.

superfluous. *See Digital-Vending Servs. Int'l, LLC v. Univ. of Phoenix, Inc.*, 672 F.3d 1270, 1275 (Fed. Cir. 2012) ("In *Phillips*, this court reinforced the importance of construing claim terms in light of the surrounding claim language, such that words in a claim are not rendered superfluous. For example, when a claim refers to 'steel baffles,' this 'strongly implies that the term "baffles" does not inherently mean objects made of steel.'") (citation omitted). There is nothing in the specification or prosecution history that supports a construction that requires two levels of spreading. The District Court improperly dismissed this problem by stating that where the claims modify the "access preamble" limitation with the words "spread" or "spreading," it "merely emphasizes that the access preamble has to be spread before transmission, in accordance with the invention's teaching." A14.

It is error to construe claims such that claim terms are sapped of meaning, do not limit the claims, and "merely emphasize" other terms in the claims. *Innova/Pure Water, Inc. v. Safari Water Filtration Systems, Inc.*, 381 F.3d 1111, 1119 (Fed. Cir. 2004) ("all claim terms are presumed to have meaning in a claim"). That error is particularly evident in this case, where the District Court found that the operative "spreading" limitation in the claims does not limit the claims, but "merely emphasizes" other terms in the claims. A14. But claim terms are not

recited for emphasis or to highlight some other term. It is presumed that all of the terms of the claims have meaning. *Id*.

Moreover, for those claims that do not recite a "spreading" or a "spread" limitation,[13] the District Court stated that its injection of "spreading" into the "preamble" limitation was appropriate because the claims recite transmissions using spread spectrum transmitters and spread spectrum receivers. A12-13. But this does not require that the preamble limitation itself be construed to require that it be "spread before transmission." Indeed, Apple has argued (incorrectly) that the preambles in the Accused Devices, which are undisputedly devices used in spread spectrum communications, are <u>not</u> spread before transmission. Thus, the District Court's assumption that "spreading" of the preambles is required in these claims, absent any support in the specification or prosecution history, is not correct.

Accordingly, it is respectfully requested that the Court construe the "access preamble/preamble" limitations to mean "a signal for communicating with the base station that is without message data," and remand this case for further proceedings.

C. Collateral Estoppel Does Not Apply to the Texas Litigation's Construction of the "Preamble" Limitations.

Apple urged the District Court to apply collateral estoppel (or issue preclusion) to the construction of the "access preamble" and "preamble"

[13] Claims 50 and 58 of the '267 patent, and claims 9-10, 14, 15, 17-19, 21-22, 24 and 26-28 of the '427 patent do not recite a "spreading" limitation. A142-44; A165-67.

limitations to justify a wholesale adoption of the construction adopted in the Texas Litigation. The District Court properly resisted Apple's invitation to err. A10-11. To the extent Apple re-raises that argument before this Court, GBT addresses it briefly below.

Regional circuit law applies to the determination of whether collateral estoppel is applicable. *See Applied Med. Res. Corp. v. U.S. Surgical Corp.*, 435 F.3d 1356, 1359-60 (Fed. Cir. 2006) (citation omitted). Under Third Circuit law, the proponent of the application of collateral estoppel must demonstrate: (1) the presentation of an identical issue; (2) which was actually litigated; (3) which was necessary to the previous decision; and (4) that the party against whom collateral estoppel will be invoked was fully represented in the prior action. *Howard Hess Dental Labs. Inc. v. Dentsply Int'l Inc.*, 602 F.3d 237, 247-248 (3d Cir. 2010). "The party seeking to invoke collateral estoppel bears the burden to prove each of its elements." *Arlington Indus., Inc. v. Bridgeport Fittings, Inc.*, 692 F. Supp. 2d 487, 501 (M.D. Pa. 2010) (citing *Dici v. Pennsylvania*, 91 F.3d 542, 548 (3d Cir. 1996)). A district court's decision regarding the applicability of collateral estoppel is reviewed under an abuse of discretion standard. *See, e.g., Source Search Techs., LLC v. LendingTree, LLC*, 588 F.3d 1063, 1074 (Fed. Cir. 2009) (applying Third Circuit law; citation omitted).

The District Court correctly determined that Apple failed to satisfy the first prong of the collateral estoppel analysis, stating:

> collateral estoppel is not applicable because the issue decided by the Texas court is not identical to that being litigated in the instant cases. The '427 patent and the reexamined '267 patent were issued on April 15, 2008 and December 25, 2009, respectively, after the conclusion of the Texas litigation (including the appeal). Neither prosecution history file was of record during that case….Therefore, collateral estoppel does not apply, and the court is not bound by the Texas court's construction of "access preamble" or the stipulated construction of "preamble" from the Texas litigation.

A11 (emphasis omitted).

The District Court’s conclusion that collateral estoppel is inapplicable was correct and in line with other decisions declining to apply collateral estoppel to a prior court’s claim construction decision. *See, e.g., Alexam, Inc. v. Best Buy Co., Inc.*, No. 2:10cv93, 2012 WL 1188406, at *7-8, 15-16 (E.D. Tex. Apr. 9, 2012) (noting that court had previously issued claim construction orders in five prior cases involving the patents-in-suit and considering reexamination prosecution history in conjunction with analyzing claim construction for a sixth time), *adopted*, 2012 WL 6790430 (E.D. Tex. Nov. 14, 2012); *Power Integrations, Inc. v. Fairchild Semiconductor Int’l, Inc.*, No. 08-309, 2009 WL 4928029, at *16-17 (D. Del. Dec. 18, 2009) (declining to apply collateral estoppel to claim construction in light of subsequent reexamination proceedings, reasoning that “the [later-arising] reexamination history needs to be considered in connection with construing the

claims."), *adopted*, 2010 WL 2985537 (D. Del. July 20, 2010), *aff'd regarding constructions*, 711 F.3d 1348 (Fed. Cir. 2013).

Accordingly, Apple failed to satisfy its burden below, and cannot meet its burden of demonstrating that the District Court abused its discretion in declining to apply collateral estoppel to the construction of the "preamble" limitation.

II. INFRINGEMENT

In addition to the claim construction issues discussed above, GBT appeals the District Court's April 9, 2013 summary judgment decision, as supplemented by the District Court's April 25, 2013 memorandum order declining to modify the District Court's non-infringement determination.[14]

A. Legal Principles and Standards of Review.

This Court reviews summary judgment decisions under regional circuit law. *See Frolow v. Wilson Sporting Goods Co.*, 710 F.3d 1303, 1308 (Fed. Cir. 2013) (citation omitted). The Third Circuit reviews the grant of summary judgment *de novo*. *Gonzalez v. Sec'y of Dep't of Homeland Sec.*, 678 F.3d 254, 257 (3d Cir. 2012).

Determining whether a device infringes a claim of a patent is a two-step process. First, the court must construe the claims at issue. Second, the Accused Devices or their method of operation must be compared to the properly construed claim to determine whether each and every limitation of the claim is met, either literally or by equivalents. *Cook Biotech Inc. v. Acell, Inc.*, 460 F.3d 1365, 1372 (Fed. Cir. 2006). Literal infringement requires that "every limitation recited in the

[14] As noted in the memorandum order, the District Court "granted" GBT's request for reconsideration, considered GBT's arguments, but declined to modify the District Court's non-infringement determination. A59.

claim is found in the accused device." *Engel Indus., Inc. v. Lockformer Co.*, 96 F.3d 1398, 1405 (Fed. Cir. 1996).

Under the *de novo* standard, this Court "reviews without deference a district court's grant of summary judgment and draws all reasonable factual inferences in favor of the non-movant." *Toro Co. v. White Consol. Indus., Inc.,* 266 F.3d 1367, 1369 (Fed. Cir. 2001); *Ethicon Endo Surgery, Inc. v. U.S. Surgical Corp.,* 149 F.3d 1309, 1315 (Fed. Cir. 1998). Summary judgment is proper only if there are no genuine issues of material fact and the movant is entitled to judgment as a matter of law. *See* Fed. R. Civ. P. 56(a); *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 255 (1986).

Infringement is a question of fact. *Crown Packaging Tech., Inc. v. Rexam Beverage Can Co.*, 559 F.3d 1308, 1312 (Fed. Cir. 2009). In the summary judgment setting, the proper inquiry is whether, drawing all justifiable inferences in favor of the non-moving party, the evidence is such that a reasonable jury could return a verdict for the non-movant. *See id.; In re Gabapentin Patent Litig.*, 503 F.3d 1254, 1259 (Fed. Cir. 2007). The District Court cannot "invade[] the province of the finder of fact, here a jury requested by [the patent owner], in deciding the infringement question." *Dorel Juvenile Grp., Inc. v. Graco Children's Prods., Inc.*, 429 F.3d 1043, 1047 (Fed. Cir. 2003) (reversing summary judgment of noninfringement because the infringement inquiry included "a question of fact

that cannot be determined on summary judgment"). Where the evidence "points in both directions….[i]t is the job of the fact-finder—not the court at summary judgment—to weigh that evidence and render a decision." *Frolow*, 710 F.3d at 1311 (citation omitted).

B. The Asserted Claims and Limitations in Dispute.

GBT asserts infringement of claims 42-44, 50-52, and 58-60 of the '267 patent, and claims 9-10, 14-22, 24, and 26-28 of the '427 patent. With respect to the '267 patent, Apple conceded that the Accused Devices or their methods of operation read on all limitations of the asserted claims, except the "spreading an access preamble," "spread access preamble," and "discrete power level" limitations. A32. With respect to the '427 patent, Apple conceded that the Accused Devices or their methods of operation read on all limitations, except the "access-burst signal," "spreading the selected preamble code," and "discrete power level" limitations. *Id*. Each "access-burst signal" limitation includes an "access preamble" and this is the only aspect of the limitation that Apple disputes for infringement. *Id*. The District Court found that in light of the undisputed facts, the Accused Devices and their methods of operation read on the "discrete power level" limitation. A35-41. However, the District Court found that the Accused Devices and their methods of operation do not practice the "spreading an access preamble"

or "spread access preamble" limitations, and therefore granted summary judgment of non-infringement for this reason.[15] A41-43.

C. Summary of GBT's Evidence Precluding Summary Judgment.

The District Court erred in granting summary judgment of non-infringement because there is substantial evidence that the Accused Devices and their methods of operation practice the "spreading an access preamble/spread access preamble" limitations. The parties stipulated that "spreading an access preamble/spread access preamble" means "increasing the bandwidth of an access preamble prior to transmission," and that "spreading the selected preamble code" means "increasing the bandwidth of a preamble."[16] A2744. The District Court construed "access preamble" to mean "a signal for communicating with the base station that is spread before transmission and that is without message data." A19. The evidence shows that the signature sequences of the Accused Devices read on the "access preamble"

[15] The District Court ostensibly granted summary judgment of non-infringement based on the "spreading an access preamble" and "spread access preamble" limitations, which the District Court stated were "recited in each asserted claim." A43. This is not correct – several asserted claims do not recite the spreading limitations. It appears that the District Court conflated the "preamble" limitation (into which it imported a spreading requirement) and the "spreading" limitations. The District Court later characterized its non-infringement determination as a finding "that the accused devices do not read on the "access preamble" limitation." A61, ¶3.

[16] For ease of reference, these limitations are referred to collectively as the "spreading an access preamble" or "spread access preamble" limitations.

limitation, and that the Accused Devices and their methods of operation do, in fact, practice the "spreading an access preamble/spread access preamble" limitations.[17]

First, the signature sequences are necessary to, and their purpose is, "communicating with a base station." The evidence shows (a) that each signature sequence is a signal composed of a unique pattern of very short, discrete impulses of energy that can be recognized by a BS (A213-14, ¶48; A749-50, ¶¶9-12); and (b) that the signature sequence signals communicate to the BS information that (i) notifies the BS that the Accused Device is initiating a random access procedure, identifies the Accused Device, and distinguishes it from other MS that are simultaneously transmitting preambles, and (ii) is necessary for the BS to respond to the Accused Device with an L1 ACK and start a communication link between the BS and Accused Device. A216-17, ¶¶50-52; A492-94, ¶¶88-91.

Second, the evidence shows that each signature sequence is "spread before transmission." As indicated above, "spreading" was stipulated to mean "increasing the bandwidth." Exhibit C to Vojcic's Report shows that every signature sequence available to the Accused Devices is spread by a scrambling code which, in turn, increases the bandwidth of the signature sequence. A213-16, ¶¶48-49; A438-54.

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[17] The District Court initially stated incorrectly that GBT "concede[d]" that its evidence was limited to showing spreading during the generation of access preambles. A42. After GBT pointed out the District Court's error, the District Court summarily rejected GBT's expert's opinions as "conclusory" in a footnote in the District Court's memorandum order declining to modify its non-infringement determination. A63, n. 7.

GBT's arguments and evidence demonstrate that in Exhibit C (i) the vertical red lines in the graphs are the preambles (or signature sequences) before spreading and that each such preamble occupies only discrete frequency components, and (ii) the overlaid blue curves are the preambles (or signature sequences) after spreading by the scrambling code and that each spread access preamble occupies the full range of frequencies. *Id*. Thus, spreading the preambles by the scrambling codes necessarily increases the range of frequencies occupied by the preambles (*i.e.*, their bandwidths).

Third, GBT has established that each preamble of the Accused Devices is a signal "that is without message data" (A213-14, ¶48), and Apple has not disputed this issue.

At the very least, there are disputed issues of fact as to whether the Accused Devices and their methods of operation practice the "spreading an access preamble/spread access preamble" limitations that preclude summary judgment.

D. The Evidence Demonstrates That Each Signature Sequence Is a "Signal for Communicating With the Base Station" That, at the Very Least, Creates a Disputed Issue of Fact That Precludes Summary Judgment.

The preamble limitation, as construed by the District Court, simply requires, in pertinent part, "a signal <u>for communicating</u> with the base station…."[18] A19

[18] Webster's defines "for" as "used as a function word to indicate **purpose** <a grant *for* studying medicine>," or as "used as a function word to indicate **an intended**

(emphasis added). There is significant evidence that in the Accused Devices the signature sequence is used "for communicating with the base station." Each signature sequence communicates to the BS information that (i) notifies the BS that the Accused Device is initiating a random access procedure, identifies the Accused Device, and distinguishes it from other MS that are simultaneously transmitting preambles, and (ii) is necessary for the BS to respond to the Accused Device with an L1 ACK and start a communication link between the BS and Accused Device. A213-17, ¶¶48-51. If the signature sequence is not "for" communicating with the BS, what is it "for?"

GBT's expert, Dr. Vojcic, describes how the signature sequences communicate information to the BS that notifies the BS that the Accused Device is initiating a random access procedure, identifies the Accused Device, and distinguishes it from other MS that are simultaneously transmitting preambles:

> The <u>**UE initiates a RA procedure by transmitting a PRACH preamble**</u> at an initial power level. *** <u>**The selected PRACH signature is repeated 256 times**</u> to obtain a sequence of [4096] chips. The <u>**repeated PRACH Signature code is then further spread with a PRACH scrambling code**</u>…available for the RA procedure for that cell…The same sets of preamble signatures may be used in adjacent cells but different preamble scrambling codes are used in the adjacent cells. That is, <u>**preamble signatures are used to separate/distinguish one PRACH preamble transmission from other simultaneous**</u>

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goal <left *for* home> <acted *for* the best>." *For*, Merriam-Webster Dictionary, http://www.merriam-webster.com/dictionary/for (last visited Sept. 9, 2013) (bold emphasis added). A2949.

> **<u>PRACH preamble transmissions</u>** in the same cell employing different signatures and the same preamble scrambling code.

A213-14, ¶48 (emphasis added).

Vojcic explains how each signature sequence further provides information necessary for the BS to respond to the Accused Device with an L1 ACK to start the communication link:

> Once the nodeB has detected one of the transmitted PRACH preambles, it transmits an acknowledgement…The **<u>acknowledgement</u>** indicator (AI) code on the AICH **<u>includes the signature of the detected PRACH preamble</u>**. **<u>This relationship with the signature signifies to the UEs that transmitted PRACH preambles which PRACH preamble is being acknowledged</u>**.

A216-17, ¶51 (emphasis added).

Vojcic relied on the testing of the Accused Devices performed by GBT's other expert, Dr. Charles Boncelet. *See, e.g.*, A223, ¶66; A302 citing, *inter alia*, A492-94, ¶¶88-91. Boncelet's testing demonstrates how the signature sequences provide communication between the Accused Device and BS by communicating an identification of the respective Accused Device/preamble and by communicating that the L1 ACK corresponds to the last transmitted preamble:

> 91. The **<u>Diagnostic File entries</u>** above **<u>show receipt of the PRACH preamble (signature 6) by the base station</u>** …, **<u>which is the PRACH preamble signature sent by the mobile station</u>**. Then …, the **<u>Diagnostic File shows that the base station sends a layer one acknowledgement corresponding to access signature 6</u>**.

A494, ¶91 (emphasis added).

> 98. As shown in the excerpt from the Diagnostic File above, the first entry … shows that **a PRACH preamble with signature 6 is detected at the base station**. Then, … the Log reflects that **an acknowledgement corresponding to signature 6 is sent from the base station to the mobile station**, acknowledging the received PRACH preamble....

A496-97, ¶98 (emphasis added).

Based on the evidence in the record, Vojcic opined that the signature sequence literally meets the "signal for communicating with the base station" aspect of the District Court's construction:

> 73. Limitation [iii], "spreading an access preamble selected from a set of pre-defined preambles," is met by the Accused Devices. I note at the outset that "preamble" and "access preamble" are used interchangeably, and that **GBT and Apple have proposed competing constructions**. While I believe GBT's proposed construction to be correct …, **I note that regardless of which construction is accepted by the Court, the limitation is met**.

A225, ¶73 (emphasis added).

> 74. Under GBT's proposed construction, "access preamble" means an access signal without message data and comprising one or more codes that distinguish one access preamble from another and used during an access procedure to facilitate establishing a communication link between a base station and a remote station. * * * Each Accused Device first randomly selects a PRACH signature from a set of available PRACH signatures. * * * The selected PRACH signature is repeated 256 times to obtain a sequence of 1024 [sic] chips. The repeated PRACH signature code is then further spread with a PRACH scrambling code (which is a PN sequence of 1024 [sic] chips) available for the RA procedure for that cell. *See*, *e.g.*,

> 3GPP TS 25.213 at 4.3.3. **As indicated above**, while **the access preambles** simultaneously transmitted by two or more users (or mobile station) may use the same PRACH scrambling code when communicating with the same base station, they would **employ different PRACH signatures**, due to random selection, **to distinguish one access preamble from another and facilitate establishing a communication link between each mobile station and the base station**. Accordingly, the access preambles of the Accused Devices literally meet GBT's proposed construction of the term. **In view of the foregoing**, **the access preambles** of the Accused Devices necessarily also **literally meet** Apple's proposed construction of this term, i.e., **a signal used for communicating with the base station** that is spread before transmission.

A225-26, ¶74 (emphasis added).

> 77. …**The Accused Devices therefore literally read on limitation [iii] under either proposed construction of "access preamble.**"[19]

A226-27, ¶77 (emphasis added).

While Apple argued that the signal for communicating must be the combination of the signature sequence and the scrambling code, the District Court impermissibly weighed the evidence and discredited the evidence put forward by GBT. Contrary to the approach taken by the District Court, the "court must assume that the evidence presented by the non-movant is credible and draw all justifiable

[19] Vojcic did not base his infringement opinion only on GBT's proposed construction, as the District Court contends. A63, ¶9. Vojcic stated unambiguously that the "access preamble" limitation is infringed under **either party's proposed construction**. A226-27, ¶77.

inferences therefrom in [GBT]'s favor." *See Loral Fairchild Corp. v. Matsushita Elec. Indus. Co., Ltd.*, 266 F.3d 1358, 1361 (Fed. Cir. 2001).

1. Vojcic's Opinions Are neither Conclusory, nor Inconsistent with a Finding That the Signature Sequence Is "A Signal for Communicating with the Base Station."

The District Court stated that Vojcic's "opinion as it relates to Apple's construction is conclusory, and does not specifically address GBT's current contention that the signature sequence alone constitutes a signal for communicating with the base station." A63. In his report, Vojcic is clear that he is reading the access preamble limitation on the signature sequence alone. A213-16, ¶¶48-49; A216-17, ¶51; A225-26, ¶74. Apple's expert Kakaes understood and explicitly acknowledged this. A638-39, ¶162. Further, Vojcic prefaced his opinion as it related to Apple's construction with the words "[i]n view of the foregoing," and therefore makes clear that his opinion is based on the earlier evidence in his report. (*See supra*, p. 51) *See Applied Med. Res. Corp. v. U.S. Surgical Corp.*, 448 F.3d 1324, 1335 (Fed. Cir. 2006) (reversing exclusion of expert declaration as "conclusory" where expert provided explanation comparing accused device to claim limitations).[20]

[20] Notably, Apple challenged certain aspects of Dr. Vojcic's opinions on *Daubert* grounds, and the District Court rejected that challenge. A2890-91. If Dr. Vojcic's opinions on Apple's proposed construction were truly conclusory, Apple itself would have made that argument in attempting to exclude Dr. Vojcic's testimony.

2. The District Court Impermissibly Conflated the 3GPP Standard's "PRACH preamble" with the Claimed "Preamble."

The claims recite "spreading an access preamble," and then transmitting the "spread access preamble." The spreading step increases the bandwidth or range of frequencies occupied by the access preamble. The patents-in-suit use the term "preamble" to identify the preamble before it is spread. A130, 5:17-34, 6:15-26. After spreading, the "preamble" is still the "preamble;" however, it is "spread." A130, 6:15-42; A131, 8:15-40. Thus, the patent uses the term "preamble" or "spread access preamble" to identify the preamble after it is spread. A131, 8:15-40; A136, 17:16-18:4, 18:12-35. Further, the claims necessarily require spreading the "preamble" during the generation of the "spread access preamble," i.e., the preamble must be spread when generating the "**<u>spread</u>** access preamble." A141, 4:16-20.

The District Court erred when it found "that the Accused Devices do not read on the 'access preamble' limitation because GBT's evidence was directed toward spreading the signature sequence during the generation of the PRACH preamble, not spreading the PRACH preamble itself." A61. The Accused Devices transmit the spread access preamble on the physical random access channel or "PRACH". A3141. The 3GPP Standard refers to the combined signature sequence and scrambling code that is transmitted on the PRACH as the "PRACH

preamble." *See*, *e.g.*, A822, A829, A835. Thus, in the Accused Devices, the "PRACH preamble" is the preamble after it is spread, i.e., the "PRACH preamble" is the "spread access preamble."

As set forth above, GBT's expert Vojcic reads the "access preamble" before it is spread on the signature sequence, and reads the "access preamble" after it is spread (i.e., the "spread access preamble") on the combined signature sequence and scrambling code, or "PRACH" preamble. Vojcic is clear that the PRACH preamble is the "final spread" preamble, not the preamble before it is spread. Vojcic states: "the **<u>final spread</u>** PRACH preamble, *i.e*., the preamble signature spread by the preamble scrambling code[.]" A214-16, ¶49, (emphasis added); *see also* A299 ("the blue curves [in Exhibit C] correspond to the power spectrum of the **<u>final spread access preamble</u>**, i.e., the preamble signature spread by the preamble scrambling code.") (emphasis added).

The District Court stated that GBT's contention "that the signature sequence alone constitutes a signal for communicating with the base station…seems inconsistent with the correct explanation contained in the same opinion that 'each access preamble is composed of two spreading codes.'" A63, n. 7. However, the statement identified by the District Court refers to the preamble <u>after</u> it is spread, and therefore is entirely consistent with GBT's contention. A225-26, ¶74. Where Vojcic's Report refers to the preamble as the combination of the signature

sequence and scrambling code, it is evident from the context that the reference to the preamble is to the preamble after it is spread, i.e., the "spread access preamble." Any semantic confusion stemming from the usage of the term "preamble" to describe the preamble both before and after spreading, is not probative of the substance of Vojcic's opinions or GBT's positions. As noted, the patent uses "preamble" to describe the preamble both before and after spreading -- when read in context, it is evident that Vojcic reads the preamble before spreading on the signature sequence, as Apple's expert specifically acknowledged. A638-39, ¶162.

3. "Facilitating Communicating" and "For Communicating" Are Not Mutually Exclusive, and Evidence of the Former Proves the Latter.

The District Court erred when it found that it is "the notion of 'facilitating,' rather than 'communicating,' that distinguishes GBT's claim construction and infringement argument from the court's claim construction and its decision on non-infringement." A63, ¶9. First, Apple never raised this argument, it was never addressed on summary judgment, and it was not appropriate for the District Court to *sua sponte* raise for the first time and decide it in response to a request for reconsideration. *See* Fed. R. Civ. P. 56(f) (district court may enter summary judgment "on grounds not raised by a party" only "after giving notice and a reasonable time to respond"); *Otis Elevator Co. v. George Washington Hotel*

Corp., 27 F.3d 903, 910 (3d. Cir. 1994) ("Under our cases, a district court may not grant summary judgment sua sponte unless the court gives notice and an opportunity to oppose summary judgment.").

Second, GBT's evidence is not based on the notion of "facilitating" rather than "communicating." To the contrary, GBT's evidence summarized above shows that the signature sequence is **the** signal that communicates with the BS. Third, the dictionary definition of "facilitate" is "to make easier" or "help bring about."[21] The concepts of "facilitating communicating" and "for communicating" are not mutually exclusive. To the contrary, a signal that makes easier or helps bring about communicating (i.e., "facilitates" communicating) may well have the purpose or intended goal of communicating (i.e., is "for" communicating).

4. The District Court Erred in Finding That the Signature Sequence Must Be Combined with the Scrambling Code To Be a "Signal for Communicating."

The District Court erred in (i) finding "that the accused devices require the **combination** of the signature sequence and the scrambling code in order to communicate with the base station" (A63-64, emphasis in original); (ii) finding that "[a] signal for communicating with the base station does not exist in the

[21] *Definition of Facilitate*, Collins American English Dictionary, http://www.collinsdictionary.com/dictionary/american/facilitate (last visited September 9, 2013); *Facilitate,* Merriam-Webster Dictionary, http://www.merriam-webster.com/dictionary/facilitate (last visited September 9, 2013). A2951; A2953.

accused devices until the access preamble is generated – the signature is multiplied to form the signature sequence which is then spread by the base station's scrambling code" (A64); and (iii) based on the foregoing, determining that "the signal for communicating with the base station is not spread prior to transmission." *Id*.

First, the District Court's claim construction only requires, in pertinent part, "a signal for communicating with the base station …." A19. As indicated above, GBT's evidence shows that each signature sequence is a signal for communicating with the BS. *Supra*, pp. 14-17, 47-52. The District Court erred by misapplying its own claim construction. Instead of simply requiring "a signal for communicating with the base station," the District Court required the signal to include additional processing performed by the Accused Devices, such as spreading with the scrambling code, in order to transmit the signals to the BS.

However, nothing in the District Court's claim construction requires the access preamble signal to have been subject to additional signal processing required for transmission. The asserted claims include the term, "comprising," and therefore "infringement is not avoided by the presence of elements or steps in addition to those specifically recited in the claim." *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 811 (Fed. Cir. 1999). The fact that the Accused Devices spread the signature sequence with a scrambling code, among other additional

signal processing steps, in order to allow the signature sequence to be transmitted to the BS, does not change the fact that the signature sequence alone is an infringing "signal for communicating with the base station." *N. Telecom Ltd. v. Samsung Elecs. Co.*, 215 F.3d 1281, 1292 (Fed. Cir. 2000) (infringement not precluded where accused process performs claimed function with elements in addition to those required by the claims).

Second, the scrambling code does not perform the communicating function. To the contrary, the scrambling code spreads the signature sequence before transmission to the BS. GBT's expert Vojcic states: "The repeated PRACH Signature code [signature sequence] is then further spread with a PRACH scrambling code (which is a PN sequence of 1024 [sic] chips) available for the RA [random access] procedure for that cell." A213-14, ¶48. Apple's expert Acampora similarly states: "the PN sequence is the code that spreads the bandwidth." A3193, ¶52. Then, when the spread access preamble (i.e., the combined signature sequence and scrambling code) is received by the BS, the BS <u>de-spreads</u> the preamble in order to recognize and process the underlying signature sequence communication. Apple's expert Dr. Acampora describes that this is how CDMA systems operate: "Using the spreading sequence associated with that signal, the receiver will de-spread that signal, producing the same – underlying bit stream." A2739-40, ¶61. This is reinforced by the teachings of the patents-in-suit and

asserted by Apple's expert as well known in the art. A570 ("the BS despreads and detects the preamble as follows: The programmable-matched filter … despreads the received spread-spectrum signal.); A2741 ("All of these components were in the prior art, and known to persons of ordinary skill in the field …").

Accordingly, the Accused Devices do <u>not</u> "require the **combination** of the signature sequence and the scrambling code in order to communicate with a base station." A63-64 (emphasis in original). To the contrary, the access preamble cannot communicate with the base station until it is de-spread at the base station to peel the scrambling code away from the signature sequence. It was error for the District Court to conclude that the signature sequence is not "a signal for communicating with the base station" for this additional reason.

5. The District Court's Non-Infringement Finding Impermissibly Excludes a Preferred Embodiment from the Claims.

The District Court's application of its claim construction excludes from the scope of the asserted claims the preferred embodiment disclosed in FIG. 4 – the same preferred embodiment the District Court imported into the "preamble" limitation in the first place.

The District Court arrived at its construction of the preamble limitation based, in part, on finding that "in Figure 4, after generation of a preamble and before transmission, a preamble is 'spread-spectrum processed by product device

426, with [a] spreading chip-sequence from spreading-sequence generator 427.'" A12. Thus, per the District Court's finding (A63-64), this embodiment would require such spread-spectrum processing, and thus combination of the spreading chip-sequence and preamble, "in order to communicate with a base station." But under this rationale, the "preamble" would not be a signal for communicating with the BS and would be excluded from the claims. *See MySpace, Inc. v. GraphOn Corp.*, 672 F.3d 1250, 1257 (Fed. Cir. 2012) (preferred embodiment should not be excluded from scope of claims).

The preferred embodiment disclosed in FIG. 3 reveals that when a spread access preamble is received at the BS, it must be de-spread in order to allow the BS to recognize and receive the underlying signal for communicating. *See* A1167-68 ("Fig. 3 [of the patents-in-suit] shows the matched filter 315 [of the base station] de-spreading signals before processing for preamble recognition …"). The District Court erred not only in finding that "the accused devices require the combination of the signature sequence and scrambling code in order to communicate with the base station" (A63-64), but in doing so applied the claim construction in a way that excludes a preferred embodiment from the claims.

GBT's evidence demonstrates that the signature sequence is a signal for communicating with the BS. This evidence must be viewed in the light most favorable to, and by drawing all reasonable inferences in favor of, GBT. When

this is done, there is, at the very least, a disputed issue of fact as to whether the signature sequence is "a signal for communicating with the base station," and thus whether the Accused Devices practice the "spreading an access preamble/spread access preamble" limitations, that precludes summary judgment of non-infringement.[22]

E. Under the Proper Construction of "Preamble," the District Court's Summary Judgment of Non-Infringement of Claims 50 and 58 of the '267 Patent and Claims 9-10, 14, 15, 17-19, 21-22, 24 and 26-28 of the '427 Patent Must Be Reversed.

Claims 50 and 58 of the '267 patent and claims 9-10, 14, 15, 17-19, 21-22, 24 and 26-28 of the '427 patent recite "transmitting … an access preamble" without any recitation of "spreading" the access preamble. A142-44; A165-67. The District Court granted summary judgment of non-infringement of these claims based upon its improper injection of a "spreading" limitation into the "preamble" limitation. When the "preamble" limitation is properly construed without the

[22] GBT and Apple stipulated that "spreading an access preamble" means "increasing the bandwidth of an access preamble." A2744. After the parties stipulated to that construction, and after GBT's experts prepared their reports establishing infringement pursuant to the plain and ordinary meaning of "bandwidth," Apple revealed and argued for the first time through the rebuttal report of Dr. Kakaes a special, litigation-driven definition of "bandwidth." A618-31, ¶¶115-45. The District Court recognized that there is a dispute between the parties as to the meaning of "bandwidth," and whether the bandwidth of the signature sequence is increased by the scrambling code. A41-42. However, the District Court declined to reach that dispute in view of its non-infringement determination. *Id.*; A63-64. *See O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1362-63 (Fed. Cir. 2008) (remanding case to district court for determination of proper construction of claim in first instance).

improper "spreading" requirement, then there is no limitation in these claims that requires "spreading" of the "preamble." Accordingly, even if the "signal for communicating" is considered to be the combination of the signature sequence and the scrambling code (as Apple contends (A633-34, ¶¶148-49) and the District Court contends), which would be incorrect for the reasons set forth above, *supra*, pp. 56-61, in the absence of any "spreading" requirement in the "preamble" limitation, the District Court's grant of summary judgment of non-infringement of claims 50 and 58 of the '267 patent and claims 9-10, 14, 15, 17-19, 21-22, 24 and 26-28 of the '427 patent must be reversed.

F. In the Alternative, the District Court Erred in Finding That the Claims Do Not Cover Spreading During Generation of the Preamble.

Although this Court should find that the signature sequence is a signal for communicating with the BS for the reasons set forth above, if this Court disagrees, and finds there are no material facts in dispute on this issue, the Court nevertheless should find that there is a disputed issue of fact that precludes summary judgment of non-infringement because the claims do not preclude spreading during generation of the "preamble."

The District Court's finding is based on the fundamentally flawed assertion by Apple that the claims require each preamble to be "(1) generated, and *then*, *subsequently*, (2) spread ….." A2869 (emphasis in original); *see also* A14; A41-42.

But there are no such steps or limitations recited in the asserted claims. First, no asserted claim recites that a preamble is first "generated." Second, no asserted claim recites a temporal limitation requiring the spreading to occur <u>after</u> a preamble is generated. To the contrary, the claims at issue recite (1) "spreading an access preamble" or (2) "spreading the selected preamble code." *See*, *e.g.*, A141, 4:8-29; A166, 14:56-64. The former has been stipulated to mean "increasing the bandwidth of an access preamble prior to transmission," and the latter has been stipulated to mean "increasing the bandwidth of a preamble." A2744. It was impermissible for the District Court to impose an additional temporal limitation on the claims. *See Baldwin Graphic Sys., Inc. v. Siebert*, *Inc.*, 512 F.3d 1338, 1345 (Fed. Cir. 2008) (improper to impose temporal restraint where not explicitly recited and not required by specification or prosecution history); *Boehringer Ingelheim Vetmedica*, *Inc. v. Schering-Plough Corp.*, 320 F.3d 1339, 1349 (Fed. Cir. 2003) (rejecting injection of temporal limitation when broader construction was supported by specification).

The claim language literally covers spreading the access preamble or preamble code either during generation of the access preamble or after. Apple's expert Kakaes conceded this: "[U]sing spreading as part of the construction of the access preamble is neither mandated nor precluded by the claim." A789, 141:20-22.

The specification and file history are entirely consistent. The specification teaches spreading the preamble during its generation. A131, 8:20-39; A124. FIG. 8 shows generation of the preamble of the preferred embodiment. *Id*. The preamble is generated by spreading a complex sequence "g" by an orthogonal Gold code "A"; the Gold code "A" increases the bandwidth of the complex sequence "g." *Id*. The parties' experts agree. A788, 136:4-11; A912-14, 317:22-324:13.

Similarly, in the Accused Devices, spreading the signature sequences by the scrambling codes increases the preamble bandwidth. A214-16, ¶49; A438-54. That the claims cover spreading such a signature sequence is reinforced by the '267 file history, where the patentee stated: "the access preamble here is itself a form of code data (**e.g., a signature**) that is spread in essentially the same manner as other data." A1167 (emphasis added).

The District Court points to the block diagram of FIG. 4 of the specification and argues that it teaches spreading the access preamble only after it is constructed. A12. This is not correct. As set forth above, the specification and file history unambiguously teach spreading the preamble code during generation of the preamble and increasing its bandwidth. FIG. 4 does not erase these teachings. A912-14, 317:22-324:13. As set forth above, either or both types of spreading are covered by the claims. It was impermissible to apply the claims so as to exclude from their scope the disclosed embodiment of spreading the access preamble

during its construction. *See Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1583-1584 (Fed. Cir. 1996) ("Such an interpretation is rarely, if ever correct and would require highly persuasive evidentiary support, which is wholly absent in this case.").

CONCLUSION

GBT respectfully requests:

1. That the Court construe the "access preamble/preamble" limitations to mean "a signal for communicating with the base station that is without message data," and remand for further infringement proceedings.

2. That the Court find, under GBT's proposed construction of the "access preamble/preamble" limitations as requested in paragraph (1) above, or alternatively, if the Court does not reverse the District Court's construction as requested in paragraph (1) above, under the District Court's construction of these limitations, that there are disputed issues of fact as to whether a signature sequence of the Accused Devices is "a signal for communicating with the base station," and that the Court remand for further infringement proceedings.

3. That the Court reverse the District Court's claim construction as requested in paragraph (1) above, and regardless of whether the Court finds disputed issues of fact as requested in paragraph (2) above, that it find there are disputed issues of fact as to whether the Accused Devices or their methods of

operation infringe the claims that do not recite "spreading," i.e., claims 50 and 58 of the '267 patent and claims 9-10, 14, 15, 17-19, 21-22, 24 and 26-28 of the '427, and remand for further infringement proceedings.

4. That if the Court does not find disputed issues of fact as requested in paragraph (2) above, that the Court nevertheless find there are disputed issues of fact as to whether the signal formed by combining the signature sequence and scrambling code in the Accused Devices is "a signal for communicating with the base station" and that such signal is "spread before transmission," and that the Court remand for further infringement proceedings.

Dated: September 10, 2013

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ADDENDUM

ADDENDUM TABLE OF CONTENTS

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

GOLDEN BRIDGE TECHNOLOGY, INC.,	)	
Plaintiff,	)	
v.	)	Civ. No. 10-428-SLR
APPLE INC., et al.,	)	
Defendants.	)	
GOLDEN BRIDGE TECHNOLOGY, INC.,	)	
Plaintiff,	)	
v.	)	Civ. No. 11-165-SLR
AMAZON.COM, INC., et al.,	)	
Defendants.	)	

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MEMORANDUM OPINION

Dated: April 9 , 2013
Wilmington, Delaware

ROBINSON, District Judge

I. INTRODUCTION

The court in this memorandum opinion construes limitations in U.S. Patent Nos. 6,574,267 B1 ("the '267 patent"), as reexamined,[1] and 7,359,427 B2 ("the '427 patent") (collectively, "the patents-in-suit"). Golden Bridge Technology, Inc. ("GBT") has asserted infringement of the patents-in-suit against numerous defendants in two suits before this court, captioned *Golden Bridge Technology, Inc. v. Apple Inc.*[2] and *Golden Bridge Technology, Inc. v. Amazon.com Inc.*[3] (D.I. 1/1)[4] The parties stayed both cases to pursue mediation, which resulted in the dismissal of several defendants. Following a status conference held by the court, the parties jointly stipulated to consolidate claim construction proceedings and to stay all claims other than those asserted against Apple. (D.I. 178/244) The parties also agreed upon, and the court approved, a procedure by which all defendants (other than Apple) could choose whether to participate in the consolidated claim construction.[5]

The parties participating in claim construction proceedings have completed consolidated claim construction briefing, and the court held oral argument on March 19,

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[1]U.S. Patent No. 6,574,267 C1.

[2]Civ. No. 10-428.

[3]Civ. No. 11-165.

[4]The papers relevant to claim construction have been docketed in both cases. The court will reference both dockets in each citation – the first D.I. number will reference docket items in Civ. No. 10-428, and the second D.I. number will reference docket items in Civ. No. 11-165.

[5]For ease of reference, the court refers to those defendants from Civ. Nos. 10-428 and 11-165 that are participating in claim construction proceedings simply as "defendants."

2013. The court has jurisdiction over these matters pursuant to 28 U.S.C. § 1338.

II. BACKGROUND

A. The Patents-In-Suit and Disputed Limitations

The patents-in-suit are assigned to GBT and list the same two inventors – Emmanuel Kanterakis and Kourosh Parsa. The '267 patent, titled "RACH Ramp-Up Acknowledgement," originally issued on June 3, 2003 with twenty-nine claims ("the original '267 patent"). Following ex parte reexamination, the United States Patent and Trademark Office ("PTO") issued a reexamination certificate on December 15, 2009, confirming the patentability of claims 1-12 and 27-29; cancelling claims 13-26; and adding new claims 30-60. The '427 patent, also titled "RACH Ramp-Up Acknowledgement," is a continuation of the '267 patent and issued on April 15, 2008.

Both patents-in-suit relate generally to wireless cellular networks and teach a method for establishing a communication link between a mobile station, such as a cellular telephone, and a base station. Rather than devoting a communication channel to each mobile station, the system contemplates a channel that allows multiple signals to be sent over the same channel and provides each remote station with random access to the channel ("RACH"). ('267 patent, col. 1:19-23, 1:27-32, 1:55-59) To establish a communication link with a base station, a mobile station must transmit a preamble at a power level high enough to be detected by the base station. However, if the power is too high, it can cause interference to other mobile stations sharing the same communication channel.

The invention teaches a "ramp-up" process to reduce the risk of interference by

ensuring the lowest detectable power level is used while providing fast communication links. A mobile station seeking to establish a connection with a base station will transmit preambles at increasing power levels until the signal is detected by a base station. Once a base station detects a preamble, it sends the mobile station an acknowledgment, after which the mobile station begins transmission of data or voice communications.

The parties agree that the patents-in-suit share the same relevant written description and figures and that the claim limitations have the same meaning throughout the patents-in-suit.[6] (*See* D.I. 193/279; D.I. 208/284 at 4; D.I. 210/286 at 2 n.1) Although the parties' joint claim construction chart identifies a number of disputed claim limitations (*see* D.I. 193/279), the parties have narrowed down the claim construction exercise, for purposes of summary judgment of the claims against Apple, to two disputed claim limitations: (1) "access preamble"/"preamble;" and (2) "discrete power level." "Access preamble" or "preamble" appears in claims 27-29, and 42-60 of the '267 patent and every claim, 1-38, of the '427 patent; "discrete power level" appears in claims 27-29, 42-44, 49-52, and 57-60 of the '267 patent and claims 3, 9-12, 14-30, and 32-35 of the '427 patent.

B. Prior Litigation Over the '267 Patent

In 2005, GBT filed suit ("the Texas litigation") in the United States District Court for the Eastern District of Texas ("the Texas court") alleging infringement of the original '267 patent against Nokia, Inc. ("Nokia") and Lucent Technologies, Inc. ("Lucent")

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[6]For convenience, the court will cite to the '267 specification.

(collectively, "the Texas defendants").[7] The Texas court issued its claim construction order on June 20, 2006, noting several limitations for which the parties had reached agreement and construing four remaining disputed limitations. (D.I. 229/292, ex. 23)

As relevant to the instant cases, the parties to the Texas litigation agreed that "preamble" means "a signal used for communication with the base station that is spread before transmission." However, they disputed the construction of "access preamble." GBT proposed the construction "a preamble selected for transmission from a set of predefined preambles," while the Texas defendants argued that an "access preamble" is "an unspread preamble." (*See id.* at JA1905) In its claim construction order, the Texas court found that "the surrounding claim language indicates that the patentee has used 'access preamble' and 'preamble' interchangeably." (*See id.*) It reasoned:

> Claim 27 provides for "spreading an access preamble selected from a set of predefined preambles; transmitting from the MS transmitter the spread access preamble." Thus, the "access preamble" is spread before it is transmitted, which is consistent with the notion that a "preamble" is "spread before transmission" as the agreed construction provides."

(*Id.*) (citation omitted) (footnote omitted) The Texas court rejected the Texas defendants' proposed construction, finding that it rested on the unsupported assumption that, before a preamble is "spread," it is necessarily "un-spread." Rather, the Texas court found that the claim language and specification "emphasize that the preamble is spread before transmission, but do not explicitly differentiate between 'spread' and 'un-spread' signals." (*Id.* at JA-1906)

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[7]GBT asserted claims 13 and 23 of the original '267 patent against Lucent and claims 23-29 against Nokia. *Golden Bridge Tech., Inc. v. Nokia, Inc.*, Civ. No. 2:05cv151, 2007 WL 294176, at *4 n.1 (E.D. Tex. Jan. 29, 2007).

On January 29, 2007, the Texas court found the asserted claims of the original '267 patent to be invalid as anticipated under 35 U.S.C. § 102(b) by two prior art publications: (1) the Mobile Station-Base Station Compatibility Standard for Dual-Mode Wideband Spectrum Cellular System IS-95A ("the IS-95A Standard"); and (2) Nokia Telecommunication's Patent Cooperative Treaty publication No. WO9746041 by Hakkinen, et al. *Golden Bridge Tech., Inc. v. Nokia, Inc.*, Civ. No. 2:05cv151, 2007 WL 294176, at *4 n.1 (E.D. Tex. Jan. 29, 2007). The Federal Circuit affirmed the invalidity decision on May 21, 2008, on grounds that GBT's sole challenge was barred for being raised, without justification, for the first time on appeal. *Golden Bridge Tech., Inc. v. Nokia, Inc.*, 527 F.3d 1318, 1324 (Fed. Cir. 2008). The Federal Circuit did not consider or address claim construction.

III. STANDARD OF REVIEW

Claim construction is a matter of law. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1330 (Fed. Cir. 2005) (en banc). Claim construction focuses on intrinsic evidence – the claims, specification and prosecution history – because intrinsic evidence is "the most significant source of the legally operative meaning of disputed claim language." *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996); *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 979 (Fed. Cir. 1995) (en banc), *aff'd*, 517 U.S. 370 (1996). Claims must be interpreted from the perspective of one of ordinary skill in the relevant art at the time of the invention. *Phillips*, 415 F.3d at 1313.

Claim construction starts with the claims, *id.* at 1312, and remains centered on the words of the claims throughout. *Interactive Gift Express, Inc. v. Compuserve, Inc.*,

256 F.3d 1323, 1331 (Fed. Cir. 2001). In the absence of an express intent to impart different meaning to claim limitations, the limitations are presumed to have their ordinary meaning. *Id.* Claims, however, must be read in view of the specification and prosecution history. Indeed, the specification is often "the single best guide to the meaning of a disputed term." *Phillips*, 415 F.3d at 1315.

IV. THE LIMITATIONS

Claim 27 of the '267 patent (from which asserted claim 51 depends) is illustrative of a method claim reciting the disputed limitations:

> 27. A method of transferring packet data for a mobile station (MS) with an MS receiver and an MS transmitter, comprising:
>
> receiving at the MS receiver a broadcast common channel from a base station;
>
> determining a plurality of parameters required for transmission of the base station;
>
> spreading an access preamble selected from a set of predefined preambles;
>
> transmitting from the MS transmitter the spread access preamble, at a first discrete power level;
>
> if NO acknowledgement corresponding to the access preamble is detected, transmitting a spread access preamble from the MS transmitter at a second discrete power level higher than the first discrete power level; and
>
> upon detecting an acknowledgement corresponding to a transmitted access preamble, ceasing preamble transmission and transmitting the packet data from the MS transmitter.

('267 patent, claim 27) Claim 29 of the '267 patent (from which asserted claim 52 depends) is illustrative of a device claim reciting the disputed limitations:

> 29. A code-division-multiple-access (CDMA) wireless handset,

> comprising:
>
> a CDMA transmitter;
>
> a CDMA receiver; and
>
> a controller coupled to the CDMA receiver for responding to signals received via the CDMA receiver and coupled for controlling the CDMA transmitter, such that in operation the CDMA handset is for performing the following steps:
>
> spreading an access preamble selected from a set of predefined preambles;
>
> transmitting the spread access preamble, at a first discrete power level to a base station;
>
> if NO acknowledgement corresponding to the access preamble is detected, transmitting a spread access preamble from the MS transmitter at a second discrete power level higher than the first discrete power level; and
>
> upon detecting an acknowledgement corresponding to a transmitted access preamble, ceasing preamble transmission and transmitting packet data from the MS transmitter.

(*Id.*, claim 29)

A. "Access Preamble"/"Preamble"

The parties agree that, consistent with the Texas court's finding, "preamble" and "access preamble" are interchangeable and, thus, should have the same construction.[8] Defendants propose the same construction that GBT and the Texas defendants stipulated to in the Texas litigation for the limitation "preamble" and that the Texas court subsequently adopted for its construction of the limitation "access preamble": "a signal used for communicating with the base station that is spread before transmission." (D.I.

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[8]For ease of reference, the court hereinafter may use "preamble" to refer to both "preamble" and "access preamble."

193/279) This construction requires that the preamble be "spread"[9] before transmission. GBT's proposed construction contains no such requirement of spreading before transmission. Instead, GBT asserts that a preamble must (1) be without message data, and (2) comprise one or more codes that allow a mobile station to be matched to a preamble. It proposes the construction: "an access signal without message data and comprising one or more codes that distinguish one access preamble/preamble from another and used during an access procedure to facilitate establishing a communication link between a base station and a remote station." (*Id.*)

1. Collateral estoppel

The court first examines, as a threshold matter, what effect the Texas litigation should have on claim construction in the instant cases. Defendants argue that, because the original '267 patent was asserted in the Texas litigation and the Texas court construed "access preamble," GBT is estopped from relitigating its meaning in this court. Regional circuit law applies to the determination of whether collateral estoppel applies. *See Applied Med. Res. Corp. v. U.S. Surgical Corp.*, 435 F.3d 1356, 1359-60 (Fed. Cir. 2008). In the Third Circuit, collateral estoppel requires: (1) the "identical" issue (2) was "actually litigated," (3) was "necessary to the decision," and (4) the party "was fully represented in the prior action." *See Howard Hess Dental Labs. Inc. v. Dentsply Intern. Inc.*, 602 F.3d 237, 247 (3d Cir. 2010); *see also Biovail Labs. Int'l SRL v. Intelgenx Corp.*, Civ. No. 09-605, 2010 WL 5625746, at *4 (D. Del. Dec. 27, 2010). Here, GBT, with representation, litigated the construction of "access preamble" in the

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[9]The parties agree that "spreading" a preamble means increasing the bandwidth of the preamble. (D.I. 193/279)

Texas court, and construction of the limitation was necessary to the invalidity decision. GBT's only argument against collateral estoppel is that the issue is not identical because "the '427 patent is a different patent, the reexamined '267 patent has different claims from those asserted in the Texas litigation, and the reexamined '267 patent has additional prosecution history that is necessarily relevant to claim construction." (D.I. 208/284 at 19; D.I. 212/288 at 1-3)

The court agrees with GBT that collateral estoppel is not applicable because the issue decided by the Texas court is not identical to that being litigated in the instant cases. The '427 patent and the reexamined '267 patent were issued on April 15, 2008 and December 25, 2009, respectively, **after** the conclusion of the Texas litigation (including the appeal). Neither prosecution history file was of record during that case. That additional prosecution history, before the court in the instant cases, does not necessarily mean that the scope of any disputed limitations changed. However, the court cannot simply ignore new prosecution history that was not of record in the Texas litigation. *See Power Integrations, Inc. v. Fairchild Semiconductor Int'l, Inc.*, Civ. No. 08-309, 2009 WL 4928029, at *16-17 & n.1 (D. Del. Dec. 19, 2009) (citing *Hawksbill Sea Turtle v. FEMA*, 126 F.3d 461, 477 (3d Cir. 1977)) (finding that collateral estoppel does not apply where subsequent "reexamination history needs to be considered in connection with construing the claims"). Therefore, collateral estoppel does not apply, and the court is not bound by the Texas court's construction of "access preamble" or the stipulated construction of "preamble" from the Texas litigation.

2. "Preamble"/"access preamble" is spread before transmission

Although GBT is not estopped from rearguing the construction of "preamble," there is nothing new in the additional new prosecution history that addresses whether or not a preamble is spread before transmission. The court finds that the construction of "access preamble" and the stipulated construction of "preamble" from the Texas litigation are still applicable insofar as they include spreading prior to transmission.

As the Texas court reasoned, the claim language and specification emphasize that a preamble is spread before transmission. According to the specification and as shown in figure 4, after generation of a preamble and before transmission, a preamble is "spread-spectrum processed by product device 426, with s spreading chip-sequence from spreading-sequence generator 427." ('267 patent, fig. 4, col. 4:38-51, 5:28-30) Although claim language is not necessarily limited to a particular embodiment, the specification is largely directed to a detailed description of the figures; it does not contemplate any other embodiment regarding generating and transmitting a preamble.

The surrounding claim language is consistent with figure 4 and the specification, and provide that an access preamble is spread before it is transmitted. For example, claims 27 and 29 of the '267 patent, from which asserted claims 51 and 52 depend, provide for "spreading an access preamble selected from a set of predefined preambles; transmitting from the MS transmitter the spread access preamble." GBT argues that several claims do not recite a "spreading an access preamble" step. (D.I. 212/288 at 6-7) However, GBT's focus on the absence of that explicit limitation in those claims is unavailing. First, all of the claims that recite a preamble or access preamble

also recite either a "spread-spectrum transmitter,"[10] a "spread-spectrum modulator" (and demodulator),[11] a "spread-spectrum wireless communication network,"[12] or "spread-spectrum transmitting."[13] A mobile station "spread-spectrum transmitter" is shown in figure 4, which the written description defines as "includ[ing] . . . [a] spreading-sequence generator 427 [that] is coupled to the product device 426." (*Id.*, col. 4:38-51) The product device 426 is the component that spreads a preamble by using a spreading chip-sequence from the spreading-sequence generator 427. (*Id.*, fig. 4, col. 5:28-30) The parties further agree that "spread spectrum" is "a communication technique wherein the transmitted information is spread in bandwidth prior to transmission over the channel and then de-spread in bandwidth by the same amount at the receiver." (D.I. 193/279) Therefore, the claims that recite transmitting a preamble or access preamble, but that do not explicitly recite a "spreading an access preamble" step, still require the spreading of preambles prior to transmission.

Moreover, construing "preamble" to require spreading prior to transmission does not impermissibly add a "spreading" step into claims that do not recite one. The patentee simply chose to draft certain claims to recite the "object" (a preamble that is spread before transmission) and the step of "transmitting" it, without explicitly reciting

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[10]See claims 45-46, 49-50, 53-54, and 58 of the '267 patent, and claims 9-10 and 26-28 of the '427 patent.

[11]See claims 47-48 and 55-57 of the '267 patent, and claims 29-31 of the '427 patent.

[12]See claims 14, 17-19 and 21-25 of the '427 patent.

[13]See claims 1-8 of the '427 patent.

the "spreading" step. That choice, however, does not change the meaning of "preamble."

GBT also asserts that defendants' proposed construction would render the claim limitation superfluous or ambiguous. (D.I. 208/284 at 21) *See Digital-Vending Servs. Int'l, LLC v. Univ. of Phoenix, Inc.*, 672 F.3d 1270, 1275 (Fed. Cir. 2012). Specifically, GBT argues that if one construes "access preamble" as a signal that is spread before transmission, the claim language – "spreading an access preamble"[14] or "spread . . . access preamble"[15] – would make it unclear whether the signal is spread more than once. The court disagrees. The word "spreading" or "spread" modifying "access preamble" merely emphasizes that the access preamble has to be spread prior to transmission, in accordance with the invention's teaching. The patents-in-suit do not differentiate between preambles that are spread before transmission and preambles that are not spread before transmission.

Finally, the court finds that the prosecution history supports the construction that the specification and claim language require. During prosecution of the original '267 patent, which is upstream from all of the patents-in-suit, the patentee argued, in response to the examiner's rejection of certain claims:

> Another disclosed distinction is that the access preamble here is itself a form of code data (e.g. a signature) **that is spread** in essentially the same manner as other data.

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[14]See claims 27-29, 42-44, 51-52, 59-60 of the '267 patent, and claims 11-13, 16, 20, 32-35, 37-38 of the '427 patent.

[15]See claims 27-29 of the '267 patent, and claims 11, 13, 33, 37, and 38 of the '427 patent.

(D.I. 227/290 at JA289) (emphasis added) Regarding proposed claims 47-49, which later issued as claims 27 and 29, the patentee opined:

> Claims 47 and 49 have been **amended to more clearly point out** certain distinctions over the prior art. Specifically, claims 47 and 49 expressly require that the power levels of the preamble transmission are distinctly different. **These amended independent claims also require that the mobile transmission involves a spreading of an access preamble**. As noted, Ozluturk uses a continuous ramp-up instead of discrete power levels. Also, **the short code and the access code used by Ozluturk do not spread or carry any type of preamble (or any other form of data). Hence, Ozluturk also does not spread an 'access preamble' as required by claims 47 and 49**.

(D.I. 227/290 at JA291) (emphasis added) While the court does not find this language to be a clear disavowal of subject matter, the fact that spreading was added "to more clearly point out" a distinction over the prior art indicates that, even prior to amendment, the patentee contemplated a preamble to be spread prior to transmission. The parties have not submitted that any portion of the additional prosecution history from the '427 patent prosecution or the reexamination of the '267 patent is relevant to whether a preamble or access preamble is spread before transmission.[16]

3. "Preamble"/"access preamble" is without message data

The parties dispute whether a preamble must be without message data.[17] In its

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[16]During reexamination, GBT submitted the construction from the Texas litigation. (D.I. 228/291 at JA797, 803) However, the court gives no weight to this submission, as it was a required disclosure. *See* 37 C.F.R. § 1.555.

[17]Defendants "do not dispute that the preamble . . . would not be understood to **contain** the type of message data the patents contemplate." (D.I. 210/286 at 19-20) Apple's expert, Dr. Kakaes, testified that "the preamble does not include a message." (D.I. 229/292 at JA1885, 219:8-220:3) Nevertheless, defendants opine that "nothing in the meaning of the term 'preamble' excludes or prohibits 'message data' (or anything else) from being transmitted **before or after** the preamble . . . ." (D.I. 210/286 at 19-20) (emphasis added)

invalidity determination, the Texas court rejected GBT's argument that the common and ordinary meaning of "preamble" should preclude message data from being included in or sent in conjunction with the preamble. *Nokia, Inc.*, 2007 WL 294176, at *1-2. The Texas court pointed out that "[p]laintiff does not cite the [c]ourt to anywhere in the specification or the claims that discuss the importance of sending a preamble alone;" it, therefore, declined to alter the previously agreed-upon construction of "preamble." *Id.* The Texas court further concluded that, because the asserted claims "do not exclude the transmission of a message or something else in addition to the preamble," and the IS-95 Standard taught transmitting a preamble and message together prior to the mobile station receiving an acknowledgment, the IS-95 Standard was an anticipatory prior art reference. *Id.* at *6.

The prosecution history of the original '267 patent did not distinguish any prior art reference on the basis that the claimed invention calls for "preamble only" transmissions. Thus, this portion of the prosecution history falls short of a clear disavowal of claim scope. However, the additional prosecution history that was not considered in the Texas litigation clearly establishes that, in order to traverse the IS-95 Standard, GBT disavowed message data being included in, or sent in conjunction with, the preamble.

The patentee asserted during reexamination that, "while IS-95 Standard does disclose . . . that each successive access probe is sent at a higher power level than the previous access probe, the access probe is a preamble plus a message. It is not just a preamble alone." (D.I. 228/291 at JA781-82) With respect to claims 27 and 28 of the '267 patent, the patentee argued: "As for the IS-95 Standard . . . , the preamble of the

present invention does not contain a message. The IS-95 Standard teaches sending the preamble and a message together and sending the acknowledgment to stop data transmission after receipt of a **preamble and message**." (*Id.* at JA784) The patentee incorporated this argument for independent claim 29, as well as several other claims. (*Id.* at JA781-82)

In its brief to the Board of Patent Appeals and Interferences, GBT again consistently asserted that, whereas each access probe in the IS-95 Standard is a preamble plus a message, the claimed preambles "do not include message data." (D.I. 228/291 at JA1160, JA1184, JA1194, JA1196) Therefore, GBT unequivocally took the position that the IS-95 Standard taught a preamble with message data and that its invention teaches a preamble without message data. In other words, GBT disclaimed subject matter during reexamination by arguing for a more narrow definition of "preamble" in order to traverse the IS-95 Standard prior art.

The written description supports the scope of the patentee's disclaimer. The specification provides that, "[u]pon receiving an [acknowledgement] the remote station starts transmission of its data." ("'267 patent, col. 7:65-66) Figure 6 shows message data being sent after the acknowledgement signal is received. (*Id.*, fig. 6, col. 6:47-48) Therefore, based on the disclaimer during reexamination, which is consistent with the written description, a "preamble" must be without message data.

4. "Preamble"/"access preamble" does not necessarily comprise one or more codes that distinguish one access preamble from another

Finally, the court finds no support for GBT's assertion that a preamble is a signal that must "compris[e] one or more codes that distinguish one access preamble from

another." GBT argues that, during prosecution of the original '267 patent, it made an explicit disclaimer that a preamble must comprise one or more codes that distinguish one preamble from another. (D.I. 208/284 at 14-17) Specifically, GBT points to the same statement discussed *supra*, made in response to the examiner's rejection of proposed claims during the prosecution of the original '267 patent: "Another disclosed distinction is that the access preamble here **is itself a form of code data (e.g. a signature)** that is spread in essentially the same manner as other data." (D.I. 227/290 at JA289) (emphasis added) Rather than emphasizing the portion of the statement asserting that a preamble is spread, GBT emphasizes that a preamble "is itself a form of code data (e.g. a signature) . . . ." However, given the context of the statement, the patentee's intent was to make a distinction from Ozluturk on the nature of the spreading, not to limit a preamble to require distinguishing code. GBT does not point to anything in the new prosecution history that would constitute a disclaimer requiring a preamble to have distinguishing code.

Given that many mobile stations are sharing a channel to access a base station, GBT does not take an unreasonable view that it would be advantageous for the base station to be able to distinguish which preamble originated from which mobile station. However, the specification does not limit a preamble in such a way. The only time the specification arguably mentions distinguishable codes is when it teaches that the "preferred approach" is that codes "**can** be chosen so that identical codes are not used in the same locations for two different preambles." ('267 patent, col. 8:37-39) (emphasis added) The same discussion, however, teaches more generally that "[t]here

are many ways of generating preamble waveforms," and even recognizes the alternative (albeit less preferable) way, of using "a single repeating code in generating each preamble." (*Id.*, col. 8:19-20, 8:32-33)[18] Such open language does not require a preamble to be comprised of one or more distinguishing codes, as GBT proposes.

5. Conclusion regarding "preamble"/"access preamble"

For the foregoing reasons, the court does not apply collateral estoppel to the claim limitations "preamble" or "access preamble." The limitations "preamble" and "access preamble" are both construed as "a signal for communicating with the base station that is spread before transmission and that is without message data."

B. "Discrete Power Level"

Defendants assert that "discrete power level" should be construed to mean "a constant distinct power level." (D.I. 193/279) GBT submits the limitation should be accorded its plain and ordinary meaning, but does not dispute defendants' proposed construction insofar as "discrete" is synonymous with "distinct." (*See* D.I. 212/288 at 11) ("The plain and ordinary meaning of 'discrete' is 'separate, distinct or non-continuous.'") Therefore, the court focuses on whether a "power level" must also be "constant," as defendants propose.[19]

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[18]GBT did not propose this limitation in the Texas litigation. As there is no new prosecution history regarding distinguishable codes in preambles and the specification provides no support for GBT's proposed limitation, the court is not inclined to depart from the Texas court's construction in this regard.

[19]It is noteworthy that GBT also initially agreed in the instant Civ. No. 10-428 case, as well as in the Texas litigation, that a "discrete power level" is "a constant distinct power level." (D.I. 210/286 at 25-26; D.I. 228/291 at JA820-31; D.I. 229/292 at JA2042, JA1888, JA1897, 1955) The Texas court did not construe "discrete power level." (*See* D.I. 228/291 at JA1237-54)

Defendants emphasize that the claims recite sending one preamble “at” a certain discrete power “level” and a next preamble “at” another higher discrete power “level.” (D.I. 210/286 at 22) They contend that the plain meaning of this language is that the first preamble is sent “at” a power level which is constant and the next preamble is sent “at” a different power level that is constant. (*Id.*) While the court is not persuaded that the plain meaning so limits “discrete power level,” the court agrees with defendants that the intrinsic evidence requires a “power level” to be “constant.”

The specification discloses only one embodiment for ramping up successive preambles. Figure 6 shows each successive preamble at a different power level, P_0, P_1, and P_2:

> FIG. 6 illustratively shows the common-packet channel access burst format, for each access-burst signal. . . . [A] first segment has a first preamble and pilot, at a first power level P_0. A second segment has a second preamble and a second pilot, at a second power level P_1. The third segment has a third preamble and a third pilot at a third power level P_2.

(‘267 patent, fig. 6, col. 5:59-6:10) The specification further teaches that “power is increased in time **from preamble to preamble in a step-wise manner**. The transmitted power during **each** preamble is **constant**.” (*Id.*, col. 7:49-51) (emphasis added) This language unambiguously describes separate preambles, where each preamble is at a power level that is “constant,” and the step-wise characteristic is seen from one preamble to another, not within a single preamble. Although claims may not always be limited to a disclosed embodiment, the patents-in-suit do not describe any other method of ramping up the power level besides that detailed in the written

description and shown in the figures.[20]

Indeed, if there is any doubt, the prosecution history also shows that a "discrete power level" must be at a "constant" level. GBT's original '267 patent application, filed March 22, 1999, had a specification that taught the above-mentioned embodiment in which a first, second, and third preamble have a first power level P_0, second power level P_1, and third power level P_2, respectively. (D.I. 227/290 at JA70-71) However, none of the original four claims recited the power of transmitted preambles. (*See id.* at JA-137-42) In several preliminary amendments prior to the initial office action, the patentee replaced the original claims with new claims "more precisely identifying the inventive subject matter of this case, specifically as it relates to use of preamble segments at different power levels and an acknowledgment signal . . . ." (*Id.* at JA194; *see also id.* at JA166-94)

Following rejection of certain claims for obviousness, the patentee filed an amendment on May 6, 2002 adding proposed claims 43-49 (which issued as claims 23-26 and, after amendment, claims 27-29), each reciting transmitting "a first preamble . . . at a first power level" and a second preamble "at a second power level . . . higher than the first power level" (claims 43, 47-49) or "transmitting a preamble at a **set** power level" and "increasing power level to a new **set** power level, and repeating the transmitting

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[20]Claims 13, 31, and 36-37 of the '427 patent recite "a plurality of constant power levels." However, these "constant power levels" are in the context of "an access-burst . . . signal comprising a plurality of segments with a plurality of constant power levels, each segment comprising [an] . . . access preamble . . . ." This claim language does not create any issue under the doctrine of claim differentiation, as it applies to segments of access-burst signals. Rather, the use of "constant" in those claims is consistent with the court's construction because even the "power level" of each "segment," which comprises an access preamble, must be "constant."

step" (claims 44-46). (*Id.* at JA218-20) (emphasis added) The examiner rejected claims 43-48 as obvious or anticipated in view of U.S. Patent No. 5,841,768 to Ozluturk et al. ("Ozluturk").

Ozluturk teaches a spread spectrum communication system for controlling initial power ramp-up. As interpreted by the examiner, it "transmits an initial minimum power level that is guaranteed to be lower than the required power level by the base station, and continues transmitting an increased power level until base station sends an indication (claimed acknowledgment)." (*See id.* at JA236) In response to the examiner's rejection, GBT asserted that independent claims 43 and 44 were patentable over Ozluturk because they

> specify transmission of **each** preamble at **one** "level." Stated another way, the entire first preamble transmission is at a **one** "first power level," and the entire second preamble transmission is at a **one** "second power level." Claim 44 specifies transmitting a preamble at a **set** power level and repeating the transmitting step at a new **set** level. The second (or new **set**) power level is higher than the first power level (or increased). A continuous ramp-up extending through a preamble transmission, as in Ozluturk, would result in a preamble transmission that continues to increase (e.g. in an inclined linear manner) during the respective preamble transmission, not **a complete transmission of a preamble at either "level," as claimed**. . . . The express claim language therefore **excludes continuous power ramp up through one or more preamble transmissions**, e.g. as a continuously increasing signal during each ongoing spreading code transmission, as is apparently the case in the Ozluturk system.

(*Id.* at JA290) (citations omitted) (emphasis added) The patentee also stated, "Ozluturk teaches continuously repeating transmissions and a linear continuous power ramp-up. Continuous transmission and ramp-up does not provide preambles, **each of which is completely at one of the different levels**, or separations between preamble

transmission." (*Id.* at JA289) (emphasis added) Therefore, the patentee narrowed the claim limitation to a power level that is at a single or set level, or "constant."[21]

GBT's statement that its claim language "excludes continuous power ramp up through one or more preamble transmissions" (*id.* at JA290), alone, may have been sufficient to traverse the continuous linear ramp-up taught in Ozluturk without going further and restricting each preamble to a single constant power level. However, the Federal Circuit has held:

> [T]here is no principle of patent law that the scope of a surrender of subject matter during prosecution is limited to what is absolutely necessary to avoid a prior art reference that was the basis for an examiner's rejection. To the contrary, it frequently happens that patentees surrender more through amendment than may have been absolutely necessary to avoid particular prior art. In such cases, we have held the patentees to the scope of what they ultimately claim, and we have not allowed them to assert that claims should be interpreted as if they had surrendered only what they had to.

Norian Corp. v. Stryker Corp., 432 F.3d 1356, 1361-62 (Fed. Cir. 2005). Even if GBT could have traversed Ozluturk with its assertion that "discrete power level" simply excludes "linear continuous" power ramp-up, such a prospect is no longer available.

Therefore, the intrinsic evidence requires each "discrete power level" to be distinct and constant. The specification uses the word "constant" and teaches an embodiment consistent with the court's construction. Furthermore, the arguments that GBT made during prosecution to traverse Ozluturk extracted the word "level," as used in "power level," to indicate that each preamble is transmitted at a power "level" that is

[21]The specification and patentee's statements also support the parties' agreement that each power level must be "distinct." The specification provides that the preambles are transmitted in a "step-wise manner" ('267 patent, col. 7:49-51), and the prosecution history confirms that each preamble is transmitted at a different, subsequently higher, power level. (D.I. 227/290 at JA289)

entirely constant. Accordingly, the court construes "discrete power level," consistent with defendants' proposed construction, to mean "a constant distinct power level."[22]

V. CONCLUSION

For the foregoing reasons, the court interprets the claim language in the '267 and '427 patents, for both Civ. Nos. 10-428 and 11-165, in the manner set forth above. An appropriate order shall issue.

[22]"Discrete power level" could alternatively be construed synonymously using GBT's words from the prosecution history file, such as "a distinct power level that is completely at one power throughout." However, the construction of a "distinct power level that is constant" uses the word "constant" from the specification and will be more straightforward for jurors to understand and apply.

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

GOLDEN BRIDGE TECHNOLOGY, INC., Plaintiff,	)	
v.	)	Civ. No. 10-428-SLR
APPLE INC., et al., Defendants.	)	
GOLDEN BRIDGE TECHNOLOGY, INC., Plaintiff,	)	
v.	)	Civ. No. 11-165-SLR
AMAZON.COM, INC., et al., Defendants.	)	

ORDER

At Wilmington this 9th day of April, 2013, consistent with the memorandum opinion issued this same date;

IT IS ORDERED that:

1. "Preamble"/"access preamble" means "a signal for communicating with the base station that is spread before transmission and that is without message data."

2. "Discrete power level" means "a constant distinct power level."

Sue L. Robinson

United States District Judge

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

GOLDEN BRIDGE TECHNOLOGY, INC.,	)	
Plaintiff,	)	
v.	)	Civ. No. 10-428-SLR
APPLE INC., et al.,	)	
Defendants.	)	

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Richard L. Horwitz, Esquire, and David E. Moore, Esquire of Potter Anderson & Corroon LLP, Wilmington, Delaware. Counsel for Defendant Apple Inc. Of Counsel: Timothy S. Teter, Esquire, and Lowell D. Mead, Esquire of Cooley LLP.

MEMORANDUM OPINION

Dated: April 9 , 2013
Wilmington, Delaware

ROBINSON, District Judge

I. INTRODUCTION

Plaintiff Golden Bridge Technology, Inc. ("GBT") filed this action against Apple, Inc. ("Apple"), three AT&T entities,[1] and Motorola Mobility LLC, alleging infringement of U.S. Patent Nos. 6,574,267 C1 ("the '267 patent"), as reexamined, and 7,359,427 ("the '427 patent") (collectively, "the patents-in-suit"). (D.I. 1)[2] GBT has asserted the same patents-in-suit against other defendants in a separate case before this court, captioned *Golden Bridge Technology, Inc. v. Amazon.com Inc.* (Civ. No. 11-165, D.I. 1) The parties stayed both cases to pursue mediation, which resulted in the dismissal of several defendants. Following a status conference held by the court, the parties jointly stipulated to consolidate claim construction proceedings and to stay all claims other than those asserted against Apple. (D.I. 178; Civ. No. 11-165, D.I. 244) The parties also agreed upon, and the court approved, a procedure by which all defendants (other than Apple) could choose whether to participate in the consolidated claim construction. The court has construed the limitations "preamble," "access preamble," and "discrete power level" in a consolidated claim construction memorandum opinion. The court has also resolved, in a separate memorandum order, various motions by GBT and Apple to exclude or strike expert testimony.

Before the court are several summary judgment motions: Apple's motion for summary judgment of invalidity (D.I. 218); GBT's motion for partial summary judgment

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[1]AT&T Inc., AT&T Corp., and AT&T Mobility LLC have been voluntarily dismissed without prejudice. (D.I. 17, 167)

[2]Unless otherwise noted, D.I. numbers refer to docket items in the instant case, Civ. No. 10-428.

of infringement (D.I. 223); and Apple's motion for summary judgment of non-infringement (D.I. 233). The court has jurisdiction over these matters pursuant to 28 U.S.C. § 1338.

II. BACKGROUND

A. The Parties

GBT is a New Jersey corporation with its principal place of business in Long Branch, New Jersey. (D.I. 1 at ¶ 1) It was founded in 1995 to develop wireless telecommunication solutions, including those employing wideband code division multiple access ("W-CDMA") technology. (D.I. 229 at JA 1848-49) In early 1998, GBT became involved in efforts to develop a third-generation ("3G") wireless standard by regularly participating on the TR 46.1 committee organized through the Telecommunications Industry Association. (D.I. 225 at A73)

Apple Inc. is a California corporation with its principal place of business in Cupertino, California. (D.I. 1 at ¶ 5) It makes, offers to sell, and sells the accused products – the Apple iPhone 3G, iPhone 3GS, iPhone 4, iPhone 4S, iPad (original), iPad 2, and (new) iPad (released March 2012) (collectively, the "accused products"). (*Id.* at ¶¶ 88, 90, 102, 104; D.I. 107 at ¶ 60)

B. Technology Overview

A code division multiple access ("CDMA") wireless cellular network consists of a base station and multiple mobile stations, such as cellular phones. To establish communication between a mobile station and a base station in a CDMA system, the mobile station transmits an access preamble over a random access channel ("RACH"). Rather than dedicating a single communication channel to each mobile station, the

CDMA system allows multiple signals to be sent over the same RACH. A mobile station trying to connect with a base station must transmit an access preamble over the RACH at a power level high enough to be detected by the base station. However, if the power is too high, it can cause interference to other mobile stations sharing the same communication channel.

C. The Patents-in-Suit

The patents-in-suit are assigned to GBT and list the same two inventors – Dr. Emmanuel Kanterakis and Dr. Kourosh Parsa. The '267 patent, titled "RACH Ramp-Up Acknowledgement," originally issued on June 3, 2003 with twenty-nine claims ("the original '267 patent"). Following ex parte reexamination, the United States Patent and Trademark Office ("PTO") issued a reexamination certificate on December 15, 2009, confirming the patentability of claims 1-12 and 27-29; cancelling claims 13-26; and adding new claims 30-60. The '427 patent, also titled "RACH Ramp-Up Acknowledgement," is a continuation of the '267 patent and issued on April 15, 2008.

The parties agree that the patents-in-suit share the same relevant written description and figures and that the claim limitations have the same meaning throughout.[3] (*See* D.I. 193; D.I. 208 at 4; D.I. 210 at 2 n.1) GBT asserts infringement of claims 42-44, 50-52, and 58-60 of the '267 patent and claims 9, 10, 14-22, 24, and 26-28 of the '427 patent. (D.I. 1)

The invention of the patents-in-suit relates to the RACH process and teaches a "ramp-up" method to "provide random channel access with reliable high data throughput

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[3]For convenience, the court will cite to the '267 specification.

and low delay on CDMA systems." ('267 patent, col. 1:19-21) This ramp-up method aims to reduce the risk of interference by ensuring the lowest detectable power level is used while providing a fast communication link. A mobile station seeking to establish a connection with a base station will transmit preambles at increasing power levels, separated by pilot signals, until the preamble is detected by a base station. The pilot signals can be set to zero power level such that they become intermittent waiting periods between preamble transmissions. Once a base station detects a preamble, it sends the mobile station an acknowledgment, after which the mobile station ceases transmitting preambles and begins transmitting data or voice communications. If no acknowledgement is received, the mobile station continues transmitting intermittent preambles, each at a higher discrete power level, until either a maximum number of preambles have been transmitted or a predetermined time has elapsed.

III. STANDARD

"The court shall grant summary judgment if the movant shows that there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law." Fed. R. Civ. P. 56(a). The moving party bears the burden of demonstrating the absence of a genuine issue of material fact. *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 415 U.S. 574, 586 n.10 (1986). A party asserting that a fact cannot be – or, alternatively, is – genuinely disputed must demonstrate such, either by citing to "particular parts of materials in the record, including depositions, documents, electronically stored information, affidavits or declarations, stipulations (including those made for the purposes of the motions only), admissions, interrogatory answers, or other materials," or by "showing that the materials cited do not establish the absence or

presence of a genuine dispute, or that an adverse party cannot produce admissible evidence to support the fact." Fed. R. Civ. P. 56(c)(1)(A) & (B). If the moving party has carried its burden, the nonmovant must then "come forward with specific facts showing that there is a genuine issue for trial." *Matsushita*, 415 U.S. at 587 (internal quotation marks omitted). The court will "draw all reasonable inferences in favor of the nonmoving party, and it may not make credibility determinations or weigh the evidence." *Reeves v. Sanderson Plumbing Prods., Inc.*, 530 U.S. 133, 150 (2000).

To defeat a motion for summary judgment, the non-moving party must "do more than simply show that there is some metaphysical doubt as to the material facts." *Matsushita*, 475 U.S. at 586-87; *see also Podohnik v. U.S. Postal Service*, 409 F.3d 584, 594 (3d Cir. 2005) (stating party opposing summary judgment "must present more than just bare assertions, conclusory allegations or suspicions to show the existence of a genuine issue") (internal quotation marks omitted). Although the "mere existence of some alleged factual dispute between the parties will not defeat an otherwise properly supported motion for summary judgment," a factual dispute is genuine where "the evidence is such that a reasonable jury could return a verdict for the nonmoving party." *Anderson v. Liberty Lobby, Inc.*, 411 U.S. 242, 247-48 (1986). "If the evidence is merely colorable, or is not significantly probative, summary judgment may be granted." *Id.* at 249-50 (internal citations omitted); *see also Celotex Corp. v. Catrett*, 411 U.S. 317, 322 (1986) (stating entry of summary judgment is mandated "against a party who fails to make a showing sufficient to establish the existence of an element essential to that party's case, and on which that party will bear the burden of proof at trial").

IV. DISCUSSION

A. Infringement

GBT moves for partial summary judgment of infringement of claims 42-44, 50-52, and 58-60 of the ‘267 patent and claims 14-22, 24, 26, and 28 of the ’427 patent (collectively, “the claims-at-issue”).[4] GBT alleges direct infringement of the device claims – claims 44, 52, and 60 of the ‘267 patent and claims 26 and 28 of the ‘427 patent. It alleges both direct and indirect infringement of the method claims – claims 42, 43, 50, 51, 58, and 59 of the ‘267 patent and claims 14-22 and 24 of the ‘427 patent. Apple moves for summary judgment of non-infringement of all asserted claims.

With respect to the ‘267 patent, Apple has conceded that the accused devices or their methods of operation read on all limitations of the asserted claims, except those that claim “spreading an access preamble” (or a “spread access preamble”), an “access preamble” (or a “preamble”), and a “discrete power level.” (*See* D.I. 225 at A613-31) With respect to the ‘427 patent claims at issue for summary judgment infringement, Apple has conceded that the accused devices or their methods of operation read on all limitations, except those that claim an “access-burst signal,” “discrete power levels,” and “spreading the selected preamble code.”[5] Each “access-burst signal” limitation includes an “access preamble,” which is the only aspect of the “access-burst signal” limitation disputed for infringement. Therefore, the court’s infringement analysis on summary

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[4]It is unclear whether GBT is moving for summary judgment of infringement of claim 10 of the ‘427 patent. (*See* D.I. 223-1) GBT is not moving for summary judgment of infringement of claims 9 and 27 of the ‘427 patent.

[5]For claims 9 and 27 of the ‘427 patent (not at issue for summary judgment), Apple also disputes the “spreading sequence generator” and “product device” limitations. Apple no longer disputes the “broadcast common synchronization channel” limitation of the asserted claims of the ‘427 patent. (*See* D.I. 234 at 49)

judgment will focus on the claim limitations reciting spreading a preamble/access preamble (or spread access preamble) and discrete power level.

GBT contends that the accused devices necessarily infringe the claims-at-issue because they establish communication with a base station in compliance with the 3G Partnership Project ("3GPP") system, which allegedly requires the invention of the patents-in-suit. (D.I. 224 at 5) GBT asserts that various testing it has conducted on the accused devices confirm infringement. (*Id.* at 5-7)

1. Standard

A patent is infringed when a person "without authority makes, uses or sells any patented invention, within the United States . . . during the term of the patent." 35 U.S.C. § 271(a). To prove direct infringement, the patentee must establish, by a preponderance of the evidence, that one or more claims of the patent read on the accused device literally or under the doctrine of equivalents. *See Advanced Cardiovascular Sys., Inc. v. Scimed Life Sys., Inc.*, 261 F.3d 1329, 1336 (Fed. Cir. 2001). A two-step analysis is employed in making an infringement determination. *See Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 976 (Fed. Cir. 1995). First, the court must construe the asserted claims to ascertain their meaning and scope. *See id.* Construction of the claims is a question of law subject to de novo review. *See Cybor Corp. v. FAS Techs.*, 138 F.3d 1448, 1454 (Fed. Cir. 1998). The trier of fact must then compare the properly construed claims with the accused infringing product. *See Markman*, 52 F.3d at 976. This second step is a question of fact. *See Bai v. L & L Wings, Inc.*, 160 F.3d 1350, 1353 (Fed. Cir. 1998).

"Direct infringement requires a party to perform each and every step or element of a claimed method or product." *BMC Res., Inc. v. Paymentech, L.P.*, 498 F.3d 1373, 1378 (Fed. Cir. 2007). "If any claim limitation is absent from the accused device, there is no literal infringement as a matter of law." *Bayer AG v. Elan Pharm. Research Corp.*, 212 F.3d 1241, 1247 (Fed. Cir. 2000). If an accused product does not infringe an independent claim, it also does not infringe any claim depending thereon. *See Wahpeton Canvas Co. v. Frontier, Inc.*, 870 F.2d 1546, 1553 (Fed. Cir. 1989). However, "[o]ne may infringe an independent claim and not infringe a claim dependent on that claim." *Monsanto Co. v. Syngenta Seeds, Inc.*, 503 F.3d 1352, 1359 (Fed. Cir. 2007) (quoting *Wahpeton Canvas*, 870 F.2d at 1552) (internal quotations omitted). A product that does not literally infringe a patent claim may still infringe under the doctrine of equivalents if the differences between an individual limitation of the claimed invention and an element of the accused product are insubstantial. *See Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 24 (1997).

To establish indirect infringement, a patent owner has available two theories: active inducement of infringement and contributory infringement. *See* 35 U.S.C. § 271(b) & (c). To establish active inducement of infringement, a patent owner must show that an accused infringer "knew or should have known [its] actions would induce actual infringements." *DSU Med. Corp. v. JMS Co., Ltd.*, 471 F.3d 1293, 1306 (Fed. Cir. 2006). To establish contributory infringement, a patent owner must show that an accused infringer sells "a component of a patented machine . . . knowing the same to be especially made or especially adapted for use in an infringement of such patent, and not a staple article or commodity of commerce suitable for substantial noninfringing use."

Golden Blount, Inc. v. Robert H. Peterson Co., 365 F.3d 1054, 1061 (Fed. Cir. 2004) (quoting 35 U.S.C. § 271(c)). Liability under either theory, however, depends on the patent owner having first shown direct infringement. *Joy Technologies, Inc. v. Flakt, Inc.*, 6 F.3d 770, 774 (Fed. Cir. 1993).

When an accused infringer moves for summary judgment of non-infringement, such relief may be granted only if one or more limitations of the claim in question does not read on an element of the accused product, either literally or under the doctrine of equivalents. *See Chimie v. PPG Indus., Inc.*, 402 F.3d 1371, 1376 (Fed. Cir. 2005); *see also TechSearch, L.L.C. v. Intel Corp.*, 286 F.3d 1360, 1369 (Fed. Cir. 2002) ("Summary judgment of non-infringement is . . . appropriate where the patent owner's proof is deficient in meeting an essential part of the legal standard for infringement, because such failure will render all other facts immaterial."). Thus, summary judgment of non-infringement can only be granted if, after viewing the facts in the light most favorable to the non-movant, there is no genuine issue as to whether the accused product is covered by the claims (as construed by the court). *See Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1304 (Fed. Cir. 1999).

2. Disputed Limitations

a. "Discrete power level"

The court has construed the limitation "discrete power level" to mean "a constant distinct power level." GBT points to various tests that it and Apple conducted as proof that the accused devices literally infringe the "discrete power level" limitation.[6] As a

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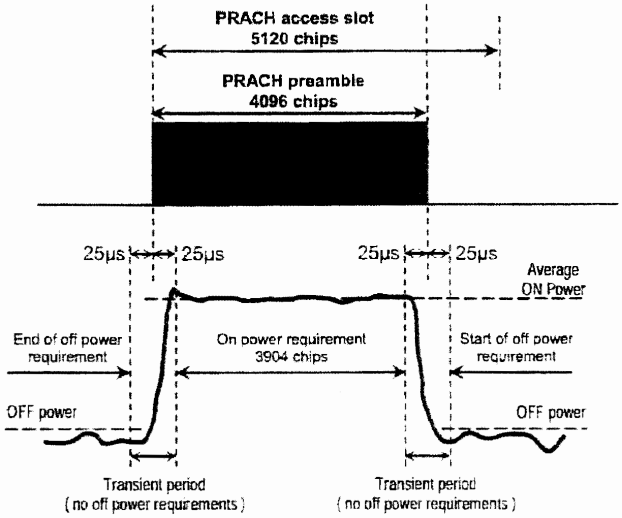
[6]For purposes of summary judgment, GBT does not assert doctrine of equivalents for the "discrete power level" limitation.

preliminary matter, GBT and Apple agree that the transmission of a preamble under the 3GPP standard is shown in figure 6.2 of 3GPP 25.101 Section 6:



(D.I. 225 at A726; *see also* D.I. 224 at 28; D.I. 234 at 10) The preamble is 4096 chips in length, and the parties agree that there are transient "ramp-up" and "ramp-down" periods over 96 chips at the very beginning and 96 chips at the very end of each preamble.[7] (*See* D.I. 251 at 6 n.4)

GBT has produced testing that a third party company, AT4, performed at the request of its expert, Dr. Boncelet. The test was a standard test, 3GPP TS 34.123-1 Section 7.1.2.3.1. (D.I. 225 at A354 at ¶ 24) The AT4 testing measured the average power of a preamble over the middle 3904-chip, or "on power," portion, of the 4096-chip

[7]Although GBT contests the shape of the transient ramp-up and ramp-down periods, it does not contest that the transient periods exist over the first 96 chips and last 96 chips of each preamble. (*See* D.I. 251 at 6 n.4)

preamble and did not provide the shape of the curve for the signal. (D.I. 248, ex. 1 at 124:13-15, 227:6-228:2) The testing found that, in the iPhone 4, the "on power" portions of the preambles were transmitted at average powers of -28.3 dB, -25.3 dB, -22.3 dB, -17.8 dB, and -11.6 dB.[8] (D.I. 225 at A376-78 at ¶¶ 78-82) From these results, another GBT expert, Dr. Vojcic, concluded that each successive preamble was transmitted at an increasingly higher, discretely different power level. (D.I. 225 at A115, ¶ 78, A187-88, A410, ¶ F) GBT concedes that the AT4 testing reports the average power over the middle 3904-chip portion of the 4096-chip preamble and that the 3GPP standard permits a preamble with transient ramp-up and ramp-down periods at the beginning and end of each preamble. (*See* D.I. 224 at 30; D.I. 251 at 19-20)

Apple avers that GBT has not shown that the accused devices transmit each preamble at a "constant" power level, as required by the court's claim construction, for three reasons. First, because the AT4 testing only measured the middle 3904-chip portion of each 4096-chip preamble, it allegedly fails to demonstrate that the accused device's preambles are transmitted "entirely" or "completely" at a constant power level. Second, Apple argues that each preamble must pass through multiple powers, not just the average measured power, because the transient ramp-up necessarily requires the preamble signal to pass through every power from 0 dB to the power at the end of ramp-up period (and vice versa for the ramp-down period). Third, as the AT4 testing only measured the average power and GBT has not produced the shape of the

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[8]Apple has performed the same test on the accused devices and found that they passed. (D.I. 225 at A407-08 at ¶ 27)

preamble's power, Apple avers that GBT has not ruled out the possibility that the measured portion of the preamble could be in any shape, even continuously ramping up. (D.I. 234 at 16-17)

The court first considers Apple's argument arising from the fact that GBT measured **average** power. Apple and GBT agree that a "constant" power level is not so rigid as to disallow some fluctuation within a tolerance range. Apple's expert, Dr. Kakaes, testified that "constant," to a person of ordinary skill in the art, does not mean "perfectly constant" but, rather, as close to constant as practically possible within system tolerance. (D.I. 225 at A688, 241:13-20) Nonetheless, Apple cites Dr. Boncelet's testimony to argue that GBT has not ruled out the possibility that the power is continuously ramping up during the measured 3904-chip portion of the preamble. Dr. Boncelet, however, qualified his response and pointed to other tests for support:

> Q: So it could well be starting lower than the average on power continuously ramping up to something above the average on power towards the end of the 3,904 chips; is that right?
>
> MR. GIARRATANA: Objection to form.
>
> THE WITNESS: Yes, but remember these are conforming the phones, so at – at some point the design passed all the tests and so we would assume that they the other tests were passed so that the other test limits how much we could deviate, but the answer is yes.

(D.I. 248, ex. 1 at 227:6-228:2)

In fact, GBT has submitted tests conducted by Apple under 3GPP test 5.13.4. (D.I. 225 at A411, ¶¶ H-I) Apple's expert, Dr. Kakaes, testified that test 5.13.4 is intended to "check that the mobile's transmitted power does not veer away from the intended power by more than, on the average, 17.5%. That's a tight constraint." (*Id.* at

A691-92, 257:25-258:3) He testified further that "if the mobile station does perform satisfactorily at that extreme, which is the most difficult region of operation, then it's going to operate satisfactorily at all lower levels." (*Id.* at A692, 258:15-19; *see also id.* at A693, 262:6-16) As the accused devices passed 3GPP test 5.13.4 (*Id.* at A411, ¶¶ H-I), Apple cannot genuinely dispute that the power stayed within the permitted tolerance such that it was "constant" at least during the preamble's middle 3904-chip portion. Therefore, the results of the AT4 testing and 3GPP test 5.13.4 together preclude any genuine dispute about the fact that, over the middle 3904-chip portion of each preamble, the preamble is at a "constant" power level.

Apple's other two arguments that the accused devices do not transmit preambles at a "constant" level are resolved by the claim construction. As construed, a "discrete power level" requires a power level that is constant. The claim language, which uses the open-ended claim language of "comprising," does not preclude a transient power ramp-up or ramp-down before or after the transmitted power level. *See Free Motion Fitness*, 423 F.3d 1343, 1353 (Fed. Cir. 2005). So long as the claimed preamble has one, and only one, discrete power level, it may include additional powers, such as a transient power ramp-up and ramp-down.

Moreover, Dr. Kakaes testified at deposition that one of ordinary skill in the art would understand that ramp-up and ramp-down periods are necessary to transmit a preamble under the 3GPP standard:

> Q: By the way, a person of ordinary skill in the art would understand that you necessarily have to have a ramp-up and a ramp-down as shown, generally, in Figure 6.2; isn't that correct?

> A: They would understand that you have to have a ramp-up and a ramp-down, but not necessarily as drawn in Figure 6.2. You could do the ramp-up and the ramp-down differently than what's shown in Figure 6.2.

(D.I. 225 at A690, 253:2-10) Relying solely on this testimony, Apple attempts to raise a factual dispute, surmising that Dr. Kakaes' testimony indicates it might be possible to transmit a preamble with an instantaneous power "on"/"off," by ramping up **prior** to transmission of a preamble and ramping down **after** transmission of the preamble. Dr. Kakaes, however, does not go as far as to opine that the ramp-up and ramp-down periods could take place entirely outside of a preamble; he only asserts, vaguely, that they could be done "differently." As Apple's conclusion that the ramp-up and ramp-down periods are unnecessary is not supported by the record, it is attorney argument that does not create a genuine issue of fact to preclude summary judgment. Dr. Kakaes' testimony reflects that ramp-up and ramp-down periods are required to transmit a preamble at a discrete power level.

Apple additionally contests whether the accused products transmit access preambles that are "distinct." It contends that, because the transient ramp-up and ramp-down periods of one preamble may pass through, or overlap, the same powers as another preamble, GBT has not carried its burden of showing that the accused devices transmit preambles that are "distinct." However, for the same reasons as above, the "discrete power level" limitation pertains to the "power levels" being distinct. As there is no genuine factual dispute that the middle 3904-chip portion of each successive preamble is distinctly different, the preambles are "discrete." In light of the undisputed

facts, the court finds that the accused devices and related processes practice the "discrete power level" limitation.

b. "Spreading the access preamble"/"spread access preamble"

Nevertheless, summary judgment of non-infringement is appropriate because GBT has not identified a genuine issue of material fact regarding the limitation of "spreading the access preamble" or of a "spread access preamble." Under the court's construction, a "preamble" or "access preamble" must be "spread prior to transmission." In other words, **the preamble itself** must be spread prior to transmission.

In this regard, GBT and Apple disagree, in their infringement arguments, as to what "spreading" entails. They agree that "spreading" a preamble means "increasing the bandwidth" of the preamble (D.I. 193), but they dispute what the plain and ordinary meaning of "bandwidth" is, pointing to the testimony of their respective experts. Citing the rebuttal report of its expert, Dr. Kakaes, Apple asserts that "bandwidth," in the context of digital signals, is determined by the rate of transmission of binary digits, or the "chip rate," so that a digital signal is "spread" when it is multiplied by a higher chip rate. (D.I. 234 at 46-47) GBT maintains that, regardless of whether a signal is analog or digital, bandwidth refers to "the range of frequencies occupied by a signal." (D.I. 224 at 15; D.I. 225 at A89-90, ¶ 31)

The court, however, need not reach which definition of "bandwidth" is applicable. GBT and Apple do not dispute that each access preamble is generated by selecting an access preamble signature (a "signature") from a set of 16 available signatures which is

then repeated 256 times to obtain the 4906-chip preamble. (D.I. 225 at A105, ¶ 50, A108, ¶ 57) GBT's infringement contention is that each signature is "spread" by a scrambling code during generation of an access preamble and that such spreading increases the access preamble bandwidth. (D.I. 224 at 4, 7, 11-15) As evidence, GBT submits power spectra produced by Dr. Vojcic, which plot the magnitude of power spectrum against frequency for each available signature before and after the purported "spreading" by a respective scrambling code.[9] (D.I. 225 at A102-04, ¶¶ 49-50, A326-42, ex. C)

GBT concedes that its evidence is limited to showing the "spreading" of signatures that allegedly takes place during the **generation** of preambles; it is unrelated to what happens after a preamble is generated. (*See, e.g.*, D.I. 224 at 7, 11-12; D.I. 251 at 27-30) GBT's evidence, even if accepted, would only show that a **signature** – not an access preamble – is spread. GBT submits no other evidence that the accused devices "spread" preambles prior to transmission.[10] Therefore, GBT's power spectra is not probative of infringement under the court's claim construction, and there is no genuine issue of material fact precluding the court's finding that GBT has not carried its burden of showing the accused products practice the "access preamble" limitation.

3. Infringement conclusion

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[9]GBT contends that "Apple has not introduced any testing, analysis or factual evidence regarding the composition or bandwidth of the access preambles of the Accused Devices." (D.I. 224 at 14) However, it is GBT's burden, not Apple's, to prove infringement.

[10]GBT offers no argument under the doctrine of equivalents for the "spreading the access preamble" or "spread access preamble" limitation. (*See* D.I. 251 at 27-33)

The accused devices do not directly infringe any of the asserted claims because they do not practice the limitation of "spreading an access preamble" or a "spread access preamble," which is recited in each asserted claim. As there can be no indirect infringement without direct infringement, the accused devices or their methods of operation also do not indirectly infringe any of the asserted claims. Accordingly, the court denies GBT's motion for partial summary judgment of infringement and grants Apple's motion for summary judgment of non-infringement.

B. Invalidity Under 35 U.S.C. § 102(e)

Apple contends that all of the asserted claims are invalid as either anticipated or rendered obvious under 35 U.S.C. § 102(e) by U.S. Patent No. 6,606,313 ("Dahlman"), entitled "Random Access in a Mobile Telecommunications System." Ericsson filed the application for Dahlman on October 5, 1998 ("the Ericsson filing date"), and the patent issued on August 12, 2003. There is no dispute that the original '267 patent application was filed on March 22, 1999 ("the GBT filing date"), after the Ericsson filing date, and constituted constructive reduction to practice by GBT. The original '267 patent is upstream of all of the patents-in-suit and lists two inventors – Dr. Kanterakis and Dr. Parsa (collectively, "the inventors").

GBT's expert, Dr. Vojcic, opined at his deposition that if Dahlman is prior art, all of the asserted claims are anticipated or obvious.[11] (D.I. 220, ex. 20 at 18:1-15) GBT

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[11]A claim is anticipated only if each and every limitation as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros., Inc. v. Union Oil Co.*, 814 F.2d 628, 631 (Fed. Cir. 1987). With respect to obviousness, "[a] patent may not be obtained . . . if the differences between the subject matter sought to be patented and the prior art are such that the subject matter

does not dispute that position. Rather, it asserts that Dahlman is not prior art because Dr. Kanterakis and Dr. Parsa conceived of the invention prior to the Ericsson filing date and proceeded with reasonable diligence until the GBT filing date. Therefore, the only issue for summary judgment of invalidity is priority of invention.

1. Standard

Under 35 U.S.C. § 102(e), a patent application may be prior art. The section provides:

> A person shall be entitled to a patent unless an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent . . . or a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent . . . .

35 U.S.C. § 102(e) (2006).[12] To determine whether a patent application is prior art under § 102(e), it is necessary to determine the patentee's date of invention. A party asserting prior invention may establish that he was the first to invent by showing that he was either: (1) the first to reduce the invention to practice; or (2) the first to conceive the invention and to then exercise reasonable diligence in attempting to reduce the invention to practice from a date just prior to the applicant's conception to the date of his reduction to practice. *See Union Carbide Chems. & Plastics Tech. Corp. v. Shell Oil Co.*, 308 F.3d 1167, 1189 (Fed. Cir. 2002). Reduction to practice may either occur actually or constructively. Actual reduction to practice requires a showing by the

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as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art." 35 U.S.C. § 103(a).

[12]Section 102, concerning novelty and loss of right to patent, has been revised by the Leahy-Smith America Invents Act, but old Section 102 still applies to this case because the asserted claims have effective filing dates before March 15, 2013.

inventor that "the invention is suitable for its intended purpose." *Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1578 (Fed. Cir. 1996). Constructive reduction to practice, in contrast, occurs when a party alleging prior invention files a patent application on the claimed invention. *Hybritech Inc. V. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1376 (Fed. Cir. 1986).

With respect to showing prior invention by conception and diligence, the inventor who was first to conceive but last to reduce to practice will prevail if he was "diligent" in reducing the invention to practice. *See* 35 U.S.C. § 102(g) ("In determining priority of invention . . . there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was the first to conceive and last to reduce to practice, from a time prior to conception by the other."). As recognized by the Federal Circuit,

> [a] principal purpose of § 102(g) is to ensure that a patent is awarded to a first inventor. However, it also encourages prompt public disclosure of an invention by penalizing the unexcused delay or failure of a first inventor to share the "benefit of the knowledge of [the] invention" with the public after the invention has been completed.

Checkpoint Sys. v. United States Int'l Trade Comm'n, 54 F.3d 756, 761 (Fed. Cir. 1995) (citing *Paulik v. Rizkalla*, 760 F.2d 1270, 1280 (Fed. Cir. 1985)).

Conception is the "formation in the inventor's mind of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice." *Hybritech*, 802 F.2d at 1376 (citations omitted). A conception must encompass all limitations of the claimed invention, and "is complete only when the idea is so clearly defined in the inventor's mind that only ordinary skill would be necessary to reduce the

invention to practice, without extensive research or experimentation." *Singh v. Brake*, 317 F.3d 1334, 1340 (Fed. Cir. 2002) (citations omitted). Put differently, every limitation must be shown to have been known to the inventor at the time the invention is alleged to have been conceived. *Davis v. Reddy*, 620 F.2d 885, 889 (C.C.P.A. 1980) (citing *Schur v. Muller*, 372 F.2d 546, 551 (1967); *Anderson v. Anderson*, 403 F. Supp. 834, 846 (D. D.C. 1975)).

Because conception is a mental act, "it must be proven by evidence showing what the inventor has disclosed to others and what that disclosure means to one of ordinary skill in the art." *In re Jolly*, 308 F.3d 1317, 1321 (Fed. Cir. 2002) (quoting *Spero v. Ringold*, 377 F.2d 652, 660 (C.C.P.A. 1967)). Corroboration by independent evidence is required where a party seeks to show conception through oral testimony of an inventor. *See id.* (citing *Price v. Symsek*, 988 F.2d 1187, 1190 (Fed. Cir. 1993)). "This requirement arose out of a concern that inventors testifying in patent infringement cases would be tempted to remember facts favorable to their case by the lure of protecting their patent or defeating another's patent." *Id.* (citing *Eibel Process Co. v. Minnesota & Ontario Paper Co.*, 261 U.S. 45, 60 (1923)). The Federal Circuit has opined that a court should apply the "rule of reason" in assessing corroboration of oral testimony. *Loral Fairchild Corp. v. Matsushita Elec.*, 266 F.3d 1358, 1363 (Fed. Cir. 2001); *Mahurkar*, 79 F.3d at 1577. That is, "[a]n evaluation of all pertinent evidence must be made so that a sound determination of the credibility of the inventor's story may be reached." *Mahurkar*, 79 F.3d at 1577 (internal quotation marks omitted) (quoting *Price*, 988 F.2d at 1195).

The party alleging prior invention must also be able to show diligence "from a date just prior to the other party's conception to . . . [the date of] reduction to practice [by the party first to conceive]." *Monsanto Co. v. Mycogen Plant Sci., Inc.*, 261 F.3d 1356, 1369 (Fed. Cir. 2002); *Mahurkar*, 79 F.3d at 1577. There is no rule requiring a specific type of activity in determining whether the applicant was reasonably diligent in proceeding toward an actual or constructive reduction to practice from the date of conception. *See Brown v. Barbacid*, 436 F.3d 1376, 1380 (Fed. Cir. 2006) ("Unlike the legal rigor of conception and reduction to practice, diligence and its corroboration may be shown by a variety of activities . . . ."). It is also not necessary for a party alleging prior invention to drop all other work and concentrate solely on the particular invention involved. *Rines v. Morgan*, 250 F.2d 365, 369 (C.C.P.A. 1957). There need not be evidence of activity on every single day if a satisfactory explanation is evidenced. *Monsanto*, 261 F.3d at 1369 (citations omitted).

"Priority of invention and its constituent issues of conception and reduction to practice are questions of law predicated on subsidiary factual findings." *Singh v. Brake*, 317 F.3d 1334, 1340 (Fed. Cir. 2003). The patentee has the burden of production in antedating a reference. However, because a patent is presumed valid, the party challenging validity bears the burden of persuasion, by clear and convincing evidence, that the invention fails to meet the requirements of patentability. *See Stamps.com Inc. v. Endicia,* Inc., 437 F. App'x 897, 907-08 (Fed. Cir. 2011) (citing *Mahurkar*, 79 F.3d at 1577-78); *see also Apotex USA, Inc. v. Merck & Co., Inc.*, 254 F.3d 1031, 1037 (Fed. Cir. 2001).

2. Evidence

a. Prior to the Ericsson filing date

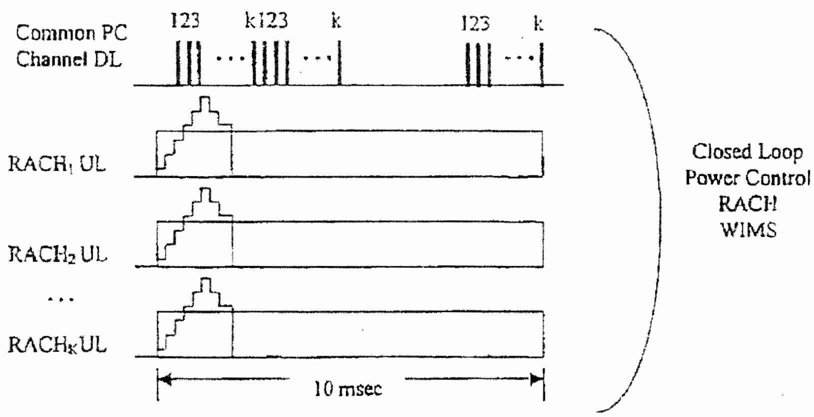
Although the inventors at bar could not recall some details regarding conception, they testified that, well before the Ericsson filing date, they had recognized the prior art RACH procedure in the CDMA system was inefficient and had started "brainstorming" a new standard that would include a faster, more efficient RACH process. (D.I. 220, ex. 21 at 230:10-231:20; D.I. 240 at PA3, 42:8-11, 42:15-18; D.I. 240 at PA275, 135:9-11, 135:22-136:1, PA279, 315:25-319:13) The inventors claim that they "conceived of the invention claimed in the '267 patent at least by the summer of 1998." (D.I. 240 at PA28-29, ¶ 41) Dr. Kanterakis testified at his deposition that "sending a preamble and waiting for an acknowledgement and sending another preamble at half power and waiting for acknowledgement was something we had discussed with [Dr. Parsa] in the summer of '98." (*Id.* at PA275, 135:22-136:1) Dr. Kanterakis also testified:

> Q: . . . Did you and Dr. Parsa conceive of the separation of the preamble from the message data, with a physical layer acknowledgement prior to transfer of any message data?
>
> A. It was within our discussion in the summer of '98.

(*Id.* at PA279, 316:24-317:4)

Dr. Parsa was GBT's representative to the TR 46.1 committee, an industry standards group that worked on 3G standards, including W-CDMA. (D.I. 225 at A74) According to Dr. Kanterakis, Dr. Parsa would ask him what features were technically possible and how to implement them in order to draft proposals for the TR 46.1 committee. (D.I. 220, ex. 22 at 185:14-186:10)

In August 1998, Dr. Parsa presented three contributions to the TR 46.1 committee, including one titled "Preamble Architecture for Closed Loop Power Control of Isolated Packets in the Uplink Direction." (D.I. 240 at PA200-15) In September 1998, Dr. Parsa made a proposal regarding a "closed loop power control" process in which "[t]he power in the preamble should be stepped up (linearly, exponentially, etc.) starting from TBD dB below the initial Open Loop Power estimate." (D.I. 220, ex. 6 at GBT00535) Figure 1 of Dr. Parsa's proposal illustrates his concept:



(*Id.*, ex. 6 at GBT00538)

On October 7, 1998, Dr. Parsa attended another TR 46.1 committee meeting and made another contribution that GBT contends, in light of its detailed nature and Dr. Parsa's traveling plans, were prepared with Dr. Kanterakis' contribution prior to the Ericsson filing date of October 5, 1998. (D.I. 239 at 12; D.I. 240 at PA55, ¶¶ 76-78, PA283-84, 313:23-314:7, 314:11-25, 316:3-8, PA355-63)

GBT's expert, Dr. Vojcic, stated that a person of ordinary skill in the art would understand that Dr. Parsa's contributions to the TR 46.1 committee, including the August, September, and October 1998 proposals, disclosed all of the limitations of the asserted claims of the patents-in-suit. (D.I. 240 at PA56-57, ¶ 79, PA60, ¶ 82) Apple points out portions of testimony that are allegedly admissions by Dr. Parsa that the TR46.1 contributions did not provide details of the invention and merely outlined goals of the invention. (D.I. 219 at 26-28)

On October 22, 1998, Ericsson, another participant in the TR 46.1 committee, pointed out that Dr. Parsa's proposal did not insert wait periods between preamble transmissions and expressed concern that the proposal might result in runaway power ramping:

> [O]ne difference is that there is no idle period between power steps in the proposal from GBT. The effect of this is that the MS might start transmitting at a too high power if the GBT proposal would be utilized. This is due mainly to the fact that the MS will keep ramping up its power not knowing that it has been acquired.
>
> . . . .
>
> The GBT proposal introduces a significant danger due to faulty power control. An MS generating a CLPC ramping header will continue to rapidly "ramp-up" until it receives an indication that a mobile has been detected. This means that the DL "stop" signal must be transmitted sufficiently robustly to ensure that any mobile contending for the channel can receive it. Otherwise, the mobile will continue to rapidly ramp up and may seriously disrupt UL traffic. Generating a "stop" signal with sufficient robustness may impact WL performance.

(D.I. 220, ex. 8 at GBT03561) Ericsson then submitted its own RACH proposal introducing wait periods between preambles transmitted at different power levels (*Id.*, ex. 9), which Apple contends reflects the patent application that Ericsson filed on October 5, 1998 and ultimately issued as Dahlman. (D.I. 219 at 7, 11) The standards-

setting committee eventually rejected GBT's proposal to use a closed loop power control feedback.[13] (*See* D.I. 240 at PA184, 136:12-18)

GBT also submits as evidence three hand-drawn sketches from two pages of a notebook belonging to Dr. Parsa. (D.I. 241 at PA687, PA697) The pages on which the sketches appear are undated, but the first sketch appears two pages after a page dated January 23, 1998 and three pages before a page dated January 27, 1998, while the second and third sketches appear several pages after the page dated January 27, 1998 and before a page dated February 26, 1998. (*Id.* at PA685, PA690, PA714)

Dr. Parsa testified that the first sketch shows a type of power ramp-up sent by intermittent preambles over a RACH and that the second and third sketches show a RACH where "nobody has [a] right of way," as well as the transmission of flat top preambles by three mobile stations and the transmission of an acknowledgement by the base station. (D.I. 240 at PA195, 47:20-49:17, PA199, 67:1-68:22) Dr. Vojcic stated that a person of ordinary skill in the art would understand the sketches to show a base station, mobile stations transmitting preambles (without data) in the shape of subsequently higher power levels in square waveforms, idle times between subsequent preambles, and an acknowledgement corresponding to detection of a preamble by the

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[13]GBT later filed an antitrust case in the United District Court for the Eastern District of Texas ("the Texas court") against Ericsson and other members of the 3G standards-setting organization, alleging an industry-wide conspiracy "to remove GBT technology from the new standards . . . for the purpose of punishing GBT and . . . render[] GBT's technology virtually valueless." (*Id.*, ex. 12 at ¶ 3) The Texas court granted summary judgment, finding that Ericsson and others did nothing actionable when they excluded GBT's intellectual property, and the Fifth Circuit affirmed. *Golden Bridge Tech., Inc. v. Motorola, Inc.*, 547 F.3d 266 (Fed. Cir. 2008).

base station. (*Id.* at PA20, ¶ 48, PA34, ¶ 46, PA37-38 at ¶¶ 51, 53)

b. Between the Ericsson filing date and the GBT filing date

After Ericsson filed the application for Dahlman, Dr. Parsa testified that he and Dr. Kanterakis continued working on the overall W-CDMA system, but the RACH process of the patents-in-suit was not high on their priority list. (D.I. 220, ex. 7 at 195:18-196:12) Both inventors attended TR 46.1 meetings on October 7-9 and October 27-29, 1998, where they presented papers directed to the RACH procedure and overall W-CDMA system. (D.I. 264 at AA3-4 ¶ 97, AA5-7 ¶¶ 99-104, AA37-73, AA8 ¶¶ 109-10, AA74-89) They also presented other papers directed to network hardware and protocols for the W-CDMA system. (*Id.* at AA74-80, AA7-8 ¶¶ 105-06, AA90-95, AA96-152, AA153-58, AA6-7 ¶¶ 102-04, AA8 ¶ 108)

Dr. Parsa continued attending TR 46.1 meetings, including ones that took place on December 14-16, 1998 and January 18-20, 1999, making presentations on the RACH procedure and overall W-CDMA system. (*Id.* at AA159-296, AA13-14 ¶¶ 125-26, 128-30, AA297-303, AA14-15 ¶ 131, AA304-11.8, AA312-21) In mid-January of 1999, the 3GPP group was formed to develop what ultimately became known as the 3GPP standard. (*Id.* at AA14-15 ¶ 131) Dr. Parsa was assigned to work on five out of seven initial submissions for 3GPP. (*Id.* at AA300-01, AA15 ¶ 132)

From mid-January until GBT's filing date, GBT contends that the inventors continued to develop and present on the network and protocols associated with the invention. Dr. Parsa made presentations to a 3GPP working group in Yokohama, Japan on February 22-25, 1999 and in Stockholm, Sweden on March 22-26, 1999. (*Id.* at

AA15 ¶ 135, AA326-40) At a March 24, 1999 TR46.1 committee meeting, Dr. Parsa presented again on the RACH procedure and its integration into a W-CDMA system.

Dr. Kanterakis testified that, on an unspecified date, he and Dr. Parsa met with GBT's patent attorney, Dr. David Newman. (D.I. 240 at PA271-72, 95-100) On February 23, 1999, Dr. Kanterakis faxed the initial draft of the patent drawings in the patents-in-suit to his secretary to finalize, and there is no dispute that his secretary forwarded those drawings to Dr. Newman on February 26, 1999. (D.I. 264 at AA415 ¶¶ 6-7) GBT avers that Dr. Newman "needed the drawings to prepare the patent application because, as is evident from the '267 patent, the specification is largely directed to a detailed description of the drawings." (D.I. 239 at 39) The application for the original '267 patent was then filed twenty-four days later, on March 22, 1999.

3. Discussion

a. Conception

As a threshold matter, GBT and Apple dispute the admissibility and use of Dr. Parsa's notebook sketches as evidence of prior conception. Regarding admissibility, Dr. Parsa confirmed that the notebook was his and that it contained his handwriting. (D.I. 220 at PA286, 335:6-336:6, 336:21-337:17) He used it as a place where he would "jot[] down whatever was bugging [him] . . . ." (*Id.* at PA286, 335:6-336:6, 336:21-337:17) Although the sketches appear on undated pages (between dated pates) and are on the back side of pages, such criticism merely goes to the weight of the evidence, not their admissibility. *See Cordance Corp. v. Amazon.com, Inc.*, 693 F. Supp. 2d 406, 433-34 (D. Del. 2009) (holding that a document was properly authenticated by its

authoring inventor and that remaining criticisms merely went to the weight of the evidence).

GBT does not attempt to use the notebook sketches by Dr. Parsa as independent corroborating evidence. *See Brown v. Barbacid*, 276 F.3d 1327, 1335 (Fed. Cir. 2002) ("[A]n inventor's own unwitnessed documentation does not corroborate an inventor's testimony about inventive facts."). Nonetheless, it asserts that the court should still consider the notebook sketches under the "rule of reason." (D.I. 239 at 27) However, the "rule of reason" applies in the context of assessing **corroborating** evidence. It requires the court to evaluate "all pertinent evidence when determining the credibility of an inventor's testimony. In order to corroborate a reduction to practice, it is not necessary to produce an actual over-the-shoulder observer. Rather, sufficient circumstantial evidence of an independent nature can satisfy the corroboration requirement." *Cooper*, 154 F.3d at 1330; *see also Hybritech*, 802 F.3d at 1377-78 (finding corroborative value in research notebooks that were either contemporaneously signed and witnessed, or prudently witnessed by other researchers within a reasonable time thereafter). Therefore, the court does not consider the notebook sketches under the "rule of reason."[14]

[14]However, the jury, as the trier of fact, may make its own determinations as to what Dr. Parsa's notebook sketches disclose. The Federal Circuit in *Brown* used a notebook as physical documentary evidence of conception that, with an explanation of its meaning to one of skill in the art, did not require corroboration "to demonstrate the content of the physical evidence itself." *Brown*, 276 F.3d at 1334, 1337; *see also Mahurkar*, 79 F.3d at 1577 ("The trier of fact can conclude for itself what documents show, aided by testimony as to what [it] would mean to one skilled in the art." (citation omitted)); *Price*, 988 F.2d at 1195-96 (finding that what a drawing discloses need not be supported by corroborating evidence, as "[o]nly the inventor's testimony requires corroboration before it can be considered").

"To avoid summary judgment, a patentee need only show that [the inventors] asserted reduction to practice prior to the [alleged prior art date], and to provide the corroborating evidence required under [the Federal Circuit's] precedent." *Loral Fairchild*, 266 F.3d at 1365. The court finds that material fact issues remain that preclude summary judgment of invalidity. The inventors alleged reduction to practice at least by the summer of 1998, which was prior to the Ericsson filing date. Apple has not offered contradictory testimony, instead highlighting passages of testimony that allegedly show the inventors could not remember some details of their inventive process. (D.I. 219 at 19-20) Although the inventors admitted having difficulty recalling some details, the court may not assess the credibility or persuasiveness of testimony when resolving motions for summary judgment.

Therefore, as GBT has offered evidence to assert conception, the issue becomes whether GBT submitted independent evidence sufficient to corroborate this assertion. *See Loral Fairchild*, 266 F.3d at 1362-63 (finding that the inventor's affidavit was sufficient to assert reduction of practice before the alleged prior art date). The primary independent evidence that GBT has submitted to corroborate the inventors' testimony is GBT's contributions to the TR 46.1 committee. (*See* D.I. 239 at 1, 22-27) GBT also submits that the TR 46.1 contributions are evidence of conception that, as physical documentary evidence in view of guidance on how one of ordinary skill in the art would understand them, do not require corroboration. GBT and Apple vigorously dispute what

the TR 46.1 contributions show.[15] GBT's expert, Dr. Vojcic, stated that one of ordinary skill in the art would understand GBT's contributions to the TR 46.1 committee, including the August, September, and October 1998 proposals, to disclose all of the limitations of the asserted claims. (D.I. 240 at PA56-57, ¶ 79, PA60, ¶ 82) Apple points out portions of Dr. Parsa's testimony that are allegedly admissions that the TR 46.1 contributions did not provide enough details and merely outlined goals of the invention. (D.I. 219 at 26-28) The court concludes that there are genuine issues of material fact regarding the import of the TR 46.1 contributions and, therefore, as to conception.[16]

b. Diligence

GBT argues that the patentees also satisfied the diligence requirement to antedate the Ericsson filing date because, between Ericsson's filing date and GBT's filing date: (1) the inventors demonstrated "engineering diligence" by attending TR46.1 committee meetings and making presentations related to the invention; and (2) their patent attorney, Dr. Newman, demonstrated "attorney diligence" by diligently working on the patent application at least after receiving Dr. Kanterakis' drawings. (D.I. 239 at 38-

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[15]There also seems to be a factual dispute regarding whether Dr. Parsa's October 7, 1998 proposal to the TR 46.1 committee is evidence of prior conception because he allegedly had to prepare the presentation before the Ericsson filing date of October 5, 1998.

[16]Apple contends that there is insufficient evidence of prior conception because Dr. Kanterakis' drawings "were necessary for Dr. Newman to constructively reduce the invention to practice," and the drawings did not exist before February 23, 1999. (D.I. 247 at 16) While GBT concedes that the drawings were important for preparing the application for the original '267 patent, Apple has not shown on summary judgment, under its burden, that the drawings were required for actual reduction to practice.

40) Viewing the evidence of record in the light most favorable to GBT, the court concludes that there are genuine issues of material fact for the jury to determine.

The court denies Apple's motion for summary judgment on invalidity.

V. CONCLUSION

For the foregoing reasons, the court denies GBT's motion for partial summary judgment of infringement; grants Apple's motion for summary judgment of non-infringement of all asserted claims; and denies Apple's motion for summary judgment of invalidity. An appropriate order shall issue.

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

GOLDEN BRIDGE TECHNOLOGY, INC.,	)	
Plaintiff,	)	
v.	)	Civ. No. 10-428-SLR
APPLE INC., et al.,	)	
Defendants.	)	

ORDER

At Wilmington this 9th day of April, 2013, consistent with the memorandum opinion issued this same date;

IT IS ORDERED that:

1. Golden Bridge Technology, Inc.'s motion for partial summary judgment of infringement against Apple Inc. ("Apple") (D.I. 223) is denied.

2. Apple's motion for summary judgment of non-infringement (D.I. 233) is granted.

3. Apple's motion for summary judgment of invalidity (D.I. 218) is denied.

Sue L. Robinson
United States District Judge

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

GOLDEN BRIDGE TECHNOLOGY, INC.,	)	
Plaintiff,	)	
v.	)	Civ. No. 10-428-SLR
APPLE INC., et al.,	)	
Defendants.	)	

MEMORANDUM ORDER

At Wilmington this 25th day of April 2013, having reviewed the motion for reconsideration filed by plaintiff Golden Bridge Technology, Inc. ("GBT") and the supplemental papers filed in connection therewith;

IT IS ORDERED that the court's decision on non-infringement found in its April 9, 2013 memorandum opinion (D.I. 322) shall not be modified,[1] for the reasons that follow:

1. **Background.** GBT filed this action against Apple Inc. ("Apple") and several other defendants, alleging infringement of U.S. Patent Nos. 6,574,267 C1 ("the '267 patent"), as reexamined, and 7,359,427 ("the '427 patent") (collectively, "the patents-in-suit"). (D.I. 1) The invention of the patents-in-suit relates to the establishment of communication between a mobile station (also referred to as "MS"), such as a cellular phone, and a base station (also referred to "BS") in a wireless cellular network. The

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[1]Although the court "granted" the motion for reconsideration (D.I. 325), it explained at the time that it only meant to review the merits of the motion, not that it meant to grant the relief sought. The court apologizes for any confusion this has caused.

mobile station attempts to connect with a base station using a “ramp up” process in which it transmits access preambles over a random access channel (“RACH”), starting at a low power level. Once a base station detects an access preamble, it sends the mobile station an acknowledgement, after which the mobile station ceases transmitting access preambles and begins transmitting data or voice communications. If no acknowledgement is received, the mobile station continues transmitting intermittent access preambles, each at a higher discrete power level, until either a maximum number of access preambles have been transmitted or a predetermined time has elapsed.

2. The parties do not dispute that the accused products[2] use a RACH process in which a preamble signature (“signature” or “PRACH signature”) is selected, repeated 256 times to form a preamble signature sequence (“signature sequence”), then combined with a scrambling code to form a PRACH preamble that is transmitted to a base station. GBT submitted power spectra as evidence that the scrambling code “spreads”[3] the signature sequence by increasing the frequency range of the signature sequence.[4]

3. The court construed “preamble”/“access preamble” to mean “a signal for communicating with the base station that is spread prior to transmission and is without

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[2]Various Apple iPhone and iPad products. (D.I. 1 at ¶¶ 88, 90, 102, 104)

[3]Apple disputes whether increasing the frequency range constitutes “spreading” under the parties’ agreed construction. (*See, e.g.*, D.I. 234 at 46-47)

[4]GBT often interchanged the terms “signature” and “signature sequence” in its summary judgment briefing. The parties have since clarified that the signature sequence, not the signature, is spread by the scrambling code.

message data."[5] (D.I. 319 at 7-17) The court subsequently issued a memorandum opinion and order dated April 9, 2013 that granted, in relevant part, Apple's motion for summary judgment of non-infringement of all asserted claims.[6] (D.I. 322, 323) The court found that the accused devices do not read on the "access preamble" limitation because GBT's evidence was directed toward spreading the signature sequence during the generation of the PRACH preamble, not spreading the PRACH preamble itself.

4. On April 10, 2013, GBT filed an emergency motion for reconsideration. (D.I. 324) The court heard oral argument the following day. GBT asserts on reconsideration that the court failed to properly apply its claim construction of the "access preamble" limitation to the accused devices. (D.I. 324, 328)

5. **Discussion.** As noted, the court adopted the following construction for the access preamble limitation: "A signal for communicating with the base station that is spread before transmission and that is without message data." The first part of the construction is consistent with that agreed to by GBT and Apple in the Texas litigation (and proposed by Apple instantly); the last phrase of the construction is consistent with GBT's proposed construction and the reexamination record.

6. In contrast to its prior position in Texas, GBT changed its construction in this litigation, to wit: "An access signal without message data and comprising one or more

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[5]The court issued its claim construction jointly with another case, captioned *Golden Bridge Technology, Inc. v. Amazon.com Inc.* (Civ. No. 11-165), in which GBT is asserting the patents-in-suit against a number of other defendants.

[6]The court also denied Apple's motion for summary judgment of invalidity of all asserted claims.

codes that distinguish one access preamble/preamble from another and used during an access procedure to facilitate establishing a communication link between a base station and a remote station." (D.I. 193) Having had both its proposed claim construction and its evidence of infringement rejected, GBT attempts to identify a genuine issue of material fact sufficient to justify trial, arguing on reconsideration that the signature sequence is an access signal without message data that is spread before transmission, thus meeting the court's claim construction.

7. The backbone of GBT's theory is its contention that the signature sequence is a "digital signal." (*See, e.g.*, D.I. 253 at A867) However, that the signature sequence may be a digital signal is of no consequence. The court's construction requires a "signal for communicating" with the base station, not a signal that merely "facilitate[s] establishing a communication link," as initially proposed by GBT.

8. In its efforts to shoe-horn its infringement theory into the court's claim construction, GBT points to the expert opinion of Dr. Vojcic:

> [I]n the Accused Devices, **each access preamble is composed of two spreading codes without message data**. Each Accused Device first randomly selects a PRACH signature from a set of available PRACH signatures. PRACH signatures are Hadamard (or OVSF) codes of length 16 that are used as channelization codes in the WCDMA system. The selected PRACH signature is repeated 256 times to obtain a sequence of [4096] chips. The repeated PRACH signature code is then further spread with a PRACH scrambling code (which is a PN sequence of [4096] chips) available for the RA procedure for that cell. As indicated above, while the access preambles simultaneously transmitted by two or more users (or MS) may use the same PRACH scrambling code when communicating with the same BS, they would employ different PRACH signatures, due to random selection, to distinguish one access preamble from another and **facilitate establishing a communication link between each MS and the BS.** Accordingly, the access preambles of the Accused Devices literally meet GBT's proposed construction of the term. In view of the

> foregoing, the access preambles of the Accused Devices necessarily also literally meet Apple's proposed construction of this term, i.e. a signal used for communicating with the base station that is spread before transmission.

(D.I. 225 at A113-14 ¶ 74) (emphasis added)

9. As is evident from the above, GBT's expert based his opinion on GBT's proposed construction.[7] By its construction, GBT tried to broaden the meaning of "signal" through use of the descriptive phrase "facilitate[s] establishing a communication link" to a base station. To "facilitate" means to make easier. **Collins English Dictionary** (10th ed. 2009). As argued by GBT, any component of the ultimate signal sent to the base station, even the signature before it is repeated, would arguably make communication possible (i.e., easier) and, therefore, could be said to facilitate communication. It is the notion of "facilitating," rather than "communicating," that distinguishes GBT's claim construction and infringement argument from the court's claim construction and its decision on non-infringement.

10. The undisputed evidence contained in the record presented during the summary judgment exercise[8] demonstrates that the accused devices require the **combination** of the signature sequence and the scrambling code in order to communicate with a base station. (*See, e.g.*, D.I. 225 at A101-02 ¶ 48, A126 ¶ 101,

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[7]The opinion as it relates to Apple's construction is conclusory, and does not specifically address GBT's current contention that the signature sequence alone constitutes a signal for communicating with the base station. Indeed, such a conclusion seems inconsistent with the correct explanation contained in the same opinion that "each access preamble is composed of two spreading codes."

[8]The court declines to review on reconsideration evidence (e.g., deposition testimony) that was not included in the summary judgment record.

A129 ¶ 107, A130 ¶ 111, A521-22 ¶ 148, A704, A710) The fact that the signature sequence is a digital signal that is spread by the scrambling code during generation of the access preamble may meet GBT's proposed claim construction, but it does not meet the claim construction the court adopted. A signal for communicating with the base station does not exist in the accused devices until the access preamble is generated – the signature is multiplied to form the signature sequence which is then spread by the base station's scrambling code. Therefore, the signal for communicating with the base station is not spread prior to transmission. Despite GBT's new attorney argument, the record evidence remains consistent with the finding of non-infringement under the operating claim construction for this case.[9]

11. **Conclusion.** For the foregoing reasons and pursuant to the memorandum order dated April 9, 2013, the court declines to change its summary judgment finding of non-infringement of all claims that were asserted against Apple. Even considering GBT's supplemental submissions and citations to the record, the court finds no expert testimony or evidence of record that raises a genuine issue of material fact to preclude summary judgment under the court's claim construction.

United States District Judge

[9]In addition to the record citations identified above, the "overwhelming" evidence cited by GBT in its reconsideration argument does not actually address the question of whether the signature sequence is "a signal for communicating with the base station:" (1) the power spectra figures prepared by its expert (D.I. 255 at A101-03 ¶¶ 48-49, A113-14 ¶ 74, A326-42 ex. C), which relate only to whether the accused devices practice "spreading;" and (2) expert testimony that explains how a mobile station determines which base station to select prior to transmitting an access preamble (*id.* at A153 ¶ 166, A368 ¶¶ 59-60, A370 ¶ 64, A393 ¶ 122).

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

GOLDEN BRIDGE TECHNOLOGY, INC.,	)	
	)	
Plaintiff,	)	
	)	
v.	)	Civ. No. 10-428-SLR
	)	
APPLE INC., et al.,	)	
	)	
Defendants.	)	

MEMORANDUM O R D E R

At Wilmington this 13th day of June, 2013, having reviewed the motion for reconsideration of the court's memorandum order dated April 25, 2013 filed by plaintiff Golden Bridge Technology, Inc. ("GBT");

IT IS ORDERED that said motion (D.I. 334) is denied for the following reasons:

1. The purpose of a motion for reconsideration is to "correct manifest errors of law or fact or to present newly discovered evidence." *Max's Seafood Cafe ex rel. Lou-Ann, Inc. v. Quinteros*, 176 F.3d 669, 677 (3d Cir. 1999). Accordingly, a court may alter or amend its judgment if the movant demonstrates at least one of the following: (1) a change in the controlling law; (2) availability of new evidence not available when summary judgment was granted; or (3) a need to correct a clear error of law or fact or to prevent manifest injustice. *See id.*

2. A motion for reconsideration is not properly grounded on a request that a court rethink a decision already made. *See Glendon Energy Co. v. Borough of Glendon*, 836 F. Supp. 1109, 1122 (E.D. Pa.1993). Motions for reargument or

reconsideration may not be used "as a means to argue new facts or issues that inexcusably were not presented to the court in the matter previously decided." *Brambles USA, Inc. v. Blocker*, 735 F. Supp. 1239, 1240 (D. Del. 1990).

3. GBT's motion rehashes the arguments it made during oral argument on April 11, 2013 and supplemental briefing. (D.I. 324, 328) Therefore, GBT has failed to demonstrate any of the aforementioned grounds to warrant a reconsideration of the court's April 25, 2013 memorandum order.[1]

Sue L. Robinson
United States District Judge

[1]GBT's request for oral argument (D.I. 338) is also denied.

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

GOLDEN BRIDGE TECHNOLOGY, INC. Plaintiff, v. APPLE INC., et al. Defendants.	))))))))))	C.A. No. 10-428-SLR

[PROPOSED] RULE 54(b) FINAL JUDGMENT

WHEREAS, on April 9, 2013, the Court issued a Memorandum Opinion regarding claim construction (D.I. 319) and an Order setting forth the Court's claim construction (D.I. 320);

WHEREAS, on April 9, 2013, the Court issued a Memorandum Opinion granting Defendant Apple, Inc.'s ("Apple") motion for summary judgment of non-infringement of the asserted claims of U.S. Patent Nos. 6,574,267 and 7,359,427 (the "patents in suit"), denying Plaintiff Golden Bridge Technology, Inc.'s ("GBT") motion for partial summary judgment of infringement of the patents in suit, and denying Apple's motion for summary judgment of invalidity of the patents in suit (D.I. 322);

WHEREAS, GBT moved for reconsideration of the Court's April 9, 2013 summary judgment decision;

WHEREAS, on April 25, 2013, the Court issued a Memorandum Order (D.I. 332) declining to modify its April 9, 2013 Memorandum Opinion (D.I. 322) granting summary judgment of non-infringement to Apple;

ME1 15649195v.3

WHEREAS, on May 9, 2013, GBT moved for reconsideration of the Court's April 25, 2013 Memorandum Order (D.I. 334);

WHEREAS, on June 13, 2013, the Court issued a Memorandum Order (D.I. 339) denying GBT's May 9, 2013 motion for reconsideration;

WHEREAS, the grant of summary judgment of non-infringement in favor of Apple (D.I. 322) and the Court's subsequent rulings (D.I. 332 and D.I. 339) did not dispose of (i) Apple's affirmative defenses, including the affirmative defense of patent invalidity; (ii) GBT's claims of infringement of the patents in suit against Defendant Motorola Mobility LLC ("Motorola"); (iii) Motorola's affirmative defenses; or (iv) Motorola's declaratory judgment counterclaims.

WHEREAS, sound judicial administration and efficiency will be served by appellate consideration of the claim construction and infringement issues set forth in the Court's April 9, 2013 rulings (D.I. 319, 320 and 322), the Court's April 25, 2013 ruling (D.I. 332), and the Court's June 13, 2013 ruling (D.I. 339); and

THEREFORE, pursuant to Rule 54(b) of the Federal Rules of Civil Procedure, this Court now makes (a) "an express determination that there is no just reason for delay;" and (b) "an express direction for the entry of judgment" as further recited in D.I. 319, 322, 332 and 339. The Court is entering this Rule 54(b) judgment for the purpose of rendering a final judgment appealable to the Federal Circuit, *see Nystrom v. Trex Co., Inc.*, 339 F.3d 1347, 1351 (Fed. Cir. 2003), which the Court believes will promote efficient judicial administration and will not result in any unfair prejudice to the parties.

This Rule 54(b) judgment does not include: (i) Apple's affirmative defenses, including the affirmative defense of patent invalidity; (ii) GBT's claims of infringement against Defendant

Motorola Mobility LLC ("Motorola"); (iii) Motorola's affirmative defenses; or (iv) Motorola's declaratory judgment counterclaims, all of which shall be STAYED pending resolution of the anticipated appeal following entry of this Rule 54(b) judgment.

IT IS SO ORDERED this 25th day of June, 2013.

Sue L. Robinson

The Honorable Sue L. Robinson
United States District Judge

ME1 15649195v.3

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

GOLDEN BRIDGE TECHNOLOGY, INC.	)	
	)	
Plaintiff,	)	
	)	C.A. No. 10-428-SLR
v.	)	
	)	
APPLE INC., et al.	)	
	)	
Defendants.	)	
	)	

AMENDED RULE 54(b) FINAL JUDGMENT

WHEREAS, on April 9, 2013, the Court issued a Memorandum Opinion regarding claim construction (D.I. 319) and an Order setting forth the Court's claim construction (D.I. 320);

WHEREAS, on April 9, 2013, the Court issued a Memorandum Opinion granting Defendant Apple, Inc.'s ("Apple") motion for summary judgment of non-infringement of the asserted claims of U.S. Patent Nos. 6,574,267 and 7,359,427 (the "patents in suit"), denying Plaintiff Golden Bridge Technology, Inc.'s ("GBT") motion for partial summary judgment of infringement of the patents in suit, and denying Apple's motion for summary judgment of invalidity of the patents in suit (D.I. 322);

WHEREAS, GBT moved for reconsideration of the Court's April 9, 2013 summary judgment decision;

WHEREAS, on April 25, 2013, the Court issued a Memorandum Order (D.I. 332) declining to modify its April 9, 2013 Memorandum Opinion (D.I. 322) granting summary judgment of non-infringement to Apple;

ME1 15874590v.1

WHEREAS, on May 9, 2013, GBT moved for reconsideration of the Court's April 25, 2013 Memorandum Order (D.I. 334);

WHEREAS, on June 13, 2013, the Court issued a Memorandum Order (D.I. 339) denying GBT's May 9, 2013 motion for reconsideration;

WHEREAS, the grant of summary judgment of non-infringement in favor of Apple (D.I. 322) and the Court's subsequent rulings (D.I. 332 and D.I. 339) did not dispose of (i) Apple's affirmative defenses, including the affirmative defense of patent invalidity; (ii) GBT's claims of infringement of the patents in suit against Defendant Motorola Mobility LLC ("Motorola"); (iii) Motorola's affirmative defenses; or (iv) Motorola's declaratory judgment counterclaims.

WHEREAS, sound judicial administration and efficiency will be served by appellate consideration of the claim construction and infringement issues set forth in the Court's April 9, 2013 rulings (D.I. 319, 320 and 322), the Court's April 25, 2013 ruling (D.I. 332), and the Court's June 13, 2013 ruling (D.I. 339); and

THEREFORE, pursuant to Rule 54(b) of the Federal Rules of Civil Procedure, this Court now makes (a) "an express determination that there is no just reason for delay;" and (b) "an express direction for the entry of judgment" as further recited in D.I. 319, 320, 322, 332 and 339. The Court is entering this Rule 54(b) judgment for the purpose of rendering a final judgment appealable to the Federal Circuit, *see Nystrom v. Trex Co., Inc.*, 339 F.3d 1347, 1351 (Fed. Cir. 2003), which the Court believes will promote efficient judicial administration and will not result in any unfair prejudice to the parties.

This Rule 54(b) judgment does not include: (i) Apple's affirmative defenses, including the affirmative defense of patent invalidity; (ii) GBT's claims of infringement against Defendant

Motorola Mobility LLC ("Motorola"); (iii) Motorola's affirmative defenses; or (iv) Motorola's declaratory judgment counterclaims, all of which shall be STAYED pending resolution of the anticipated appeal following entry of this Rule 54(b) judgment.

IT IS SO ORDERED this 1st day of July, 2013.

Sue L. Robinson

The Honorable Sue L. Robinson
United States District Judge

ME1 15874590v.1

US006574267B1

(12) **United States Patent**
Kanterakis et al.

(10) **Patent No.: US 6,574,267 B1**
(45) **Date of Patent: Jun. 3, 2003**

(54) **RACH RAMP-UP ACKNOWLEDGEMENT**

(75) Inventors: **Emmanuel Kanterakis**, North Brunswick, NJ (US); **Kourosh Parsa**, Riverside, CT (US)

(73) Assignee: **Golden Bridge Technology, Inc.**, West Long Branch, NJ (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/273,450**

(22) Filed: **Mar. 22, 1999**

(51) **Int. Cl.**[7] **H04B 1/69**; H04B 7/216
(52) **U.S. Cl.** **375/141**; 370/342
(58) **Field of Search** 375/130, 141; 370/342, 335, 320, 321, 324, 441

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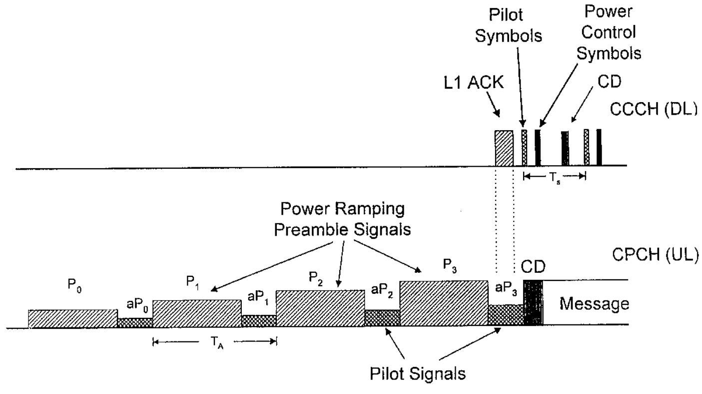
Primary Examiner—Tesfaldet Bocure
(74) *Attorney, Agent, or Firm*—McDermott, Will & Emery

(57) **ABSTRACT**

An improvement to a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a base station (BS) with a BS-spread-spectrum transmitter and a BS-spread-spectrum receiver, and a plurality of remote stations. Each remote station (RS) has an RS-spread-spectrum transmitter and an RS-spread-spectrum receiver. The improvement includes the steps of transmitting from the BS-spread-spectrum transmitter, a broadcast common-synchronization channel. The broadcast common-synchronization channel has a common chip-sequence signal common to the plurality of remote stations, and a frame-timing signal. The improvement includes receiving at a first RS-spread-spectrum receiver the broadcast common-synchronization channel, and determining frame timing from the frame-timing signal, and transmitting from a first RS-spread-spectrum transmitter an access-burst signal. The access-burst signal has a plurality of segments, which have a plurality of power levels. At the BS-spread-spectrum receiver the access-burst signal is received at a detected-power level. In response to receiving the access-burst signal, the BS-spread-spectrum transmitter transmits to the first RS-spread-spectrum receiver an acknowledgment signal. The first RS-spread-spectrum receiver receives the acknowledgment signal, and in response to receiving the acknowledgment signal, the first RS-spread-spectrum transmitter transmits to the BS-spread-spectrum receiver, a spread-spectrum signal having data.

29 Claims, 11 Drawing Sheets



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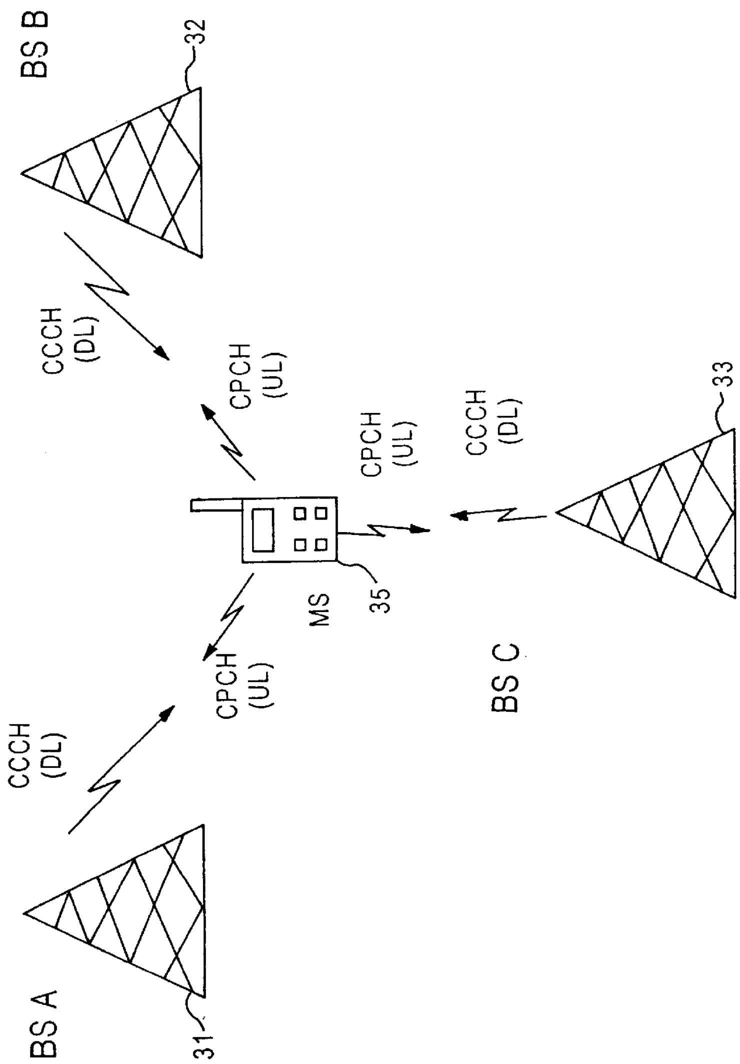
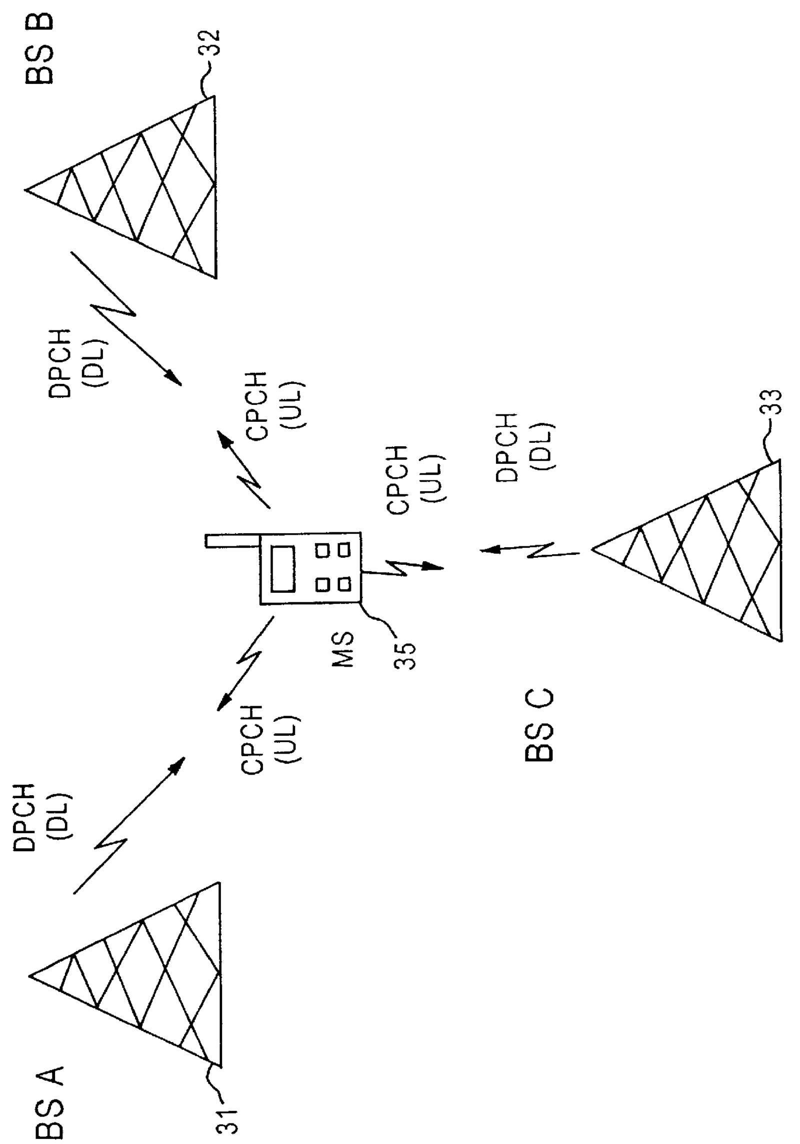

BS B
32
CCCH (DL)
CPCH (UL)
CPCH (UL)
CCCH (DL)
33
MS
35
CPCH (UL)
BS C
CCCH (DL)
BS A
31

FIG. 1



BS B
32
DPCH
(DL)
CPCH
(UL)
CPCH
(UL)
DPCH
(DL)
33
MS
35
CPCH
(UL)
BS C
DPCH
(DL)
BS A
31

FIG. 2

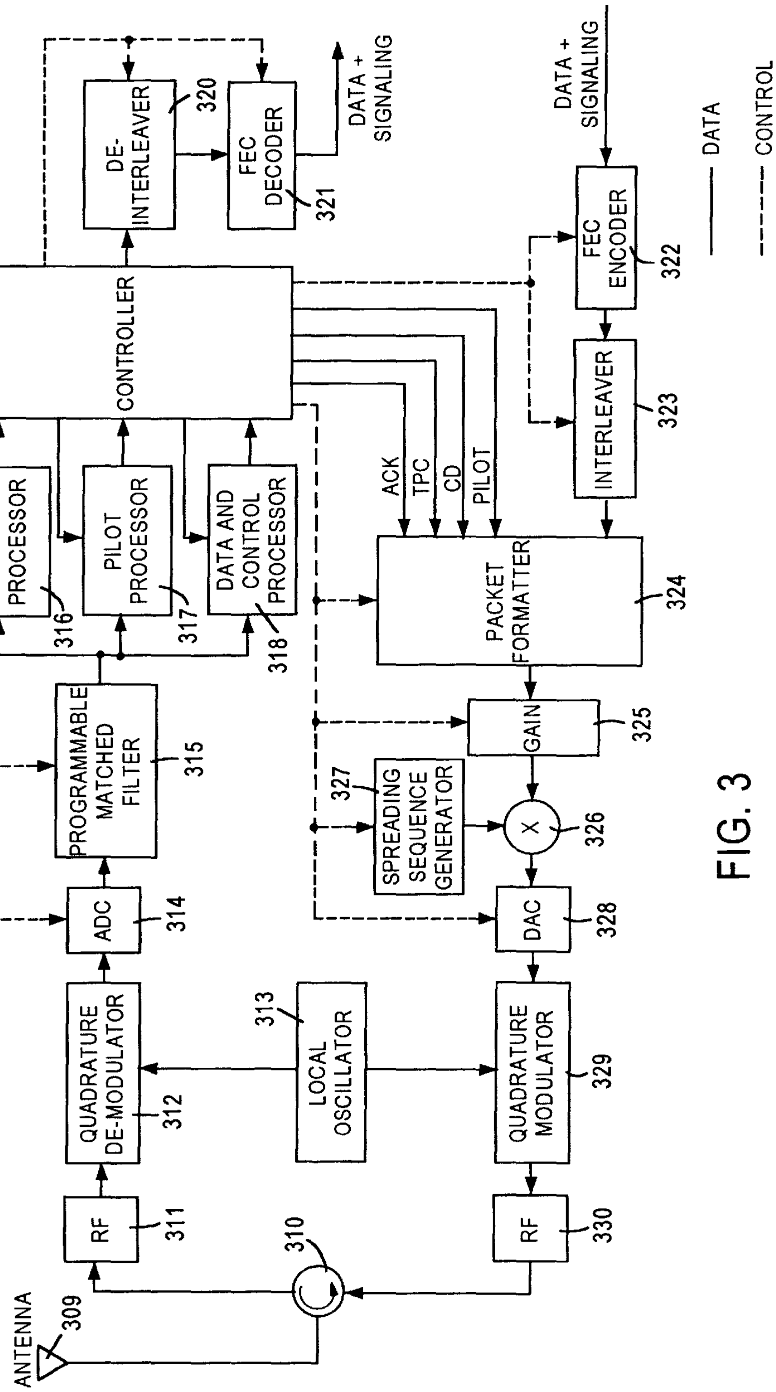

DE-INTERLEAVER
320
FEC DECODER
321
DATA + SIGNALING
319
CONTROLLER
DATA + SIGNALING
FEC ENCODER
322
DATA
CONTROL
INTERLEAVER
323
ACK
TPC
CD
PILOT
PREAMBLE PROCESSOR
316
PILOT PROCESSOR
317
DATA AND CONTROL PROCESSOR
318
PACKET FORMATTER
324
PROGRAMMABLE MATCHED FILTER
315
GAIN
325
SPREADING SEQUENCE GENERATOR
327
X
326
ADC
314
DAC
328
QUADRATURE DE-MODULATOR
312
313
LOCAL OSCILLATOR
QUADRATURE MODULATOR
329
RF
311
310
RF
330
ANTENNA
309

FIG. 3

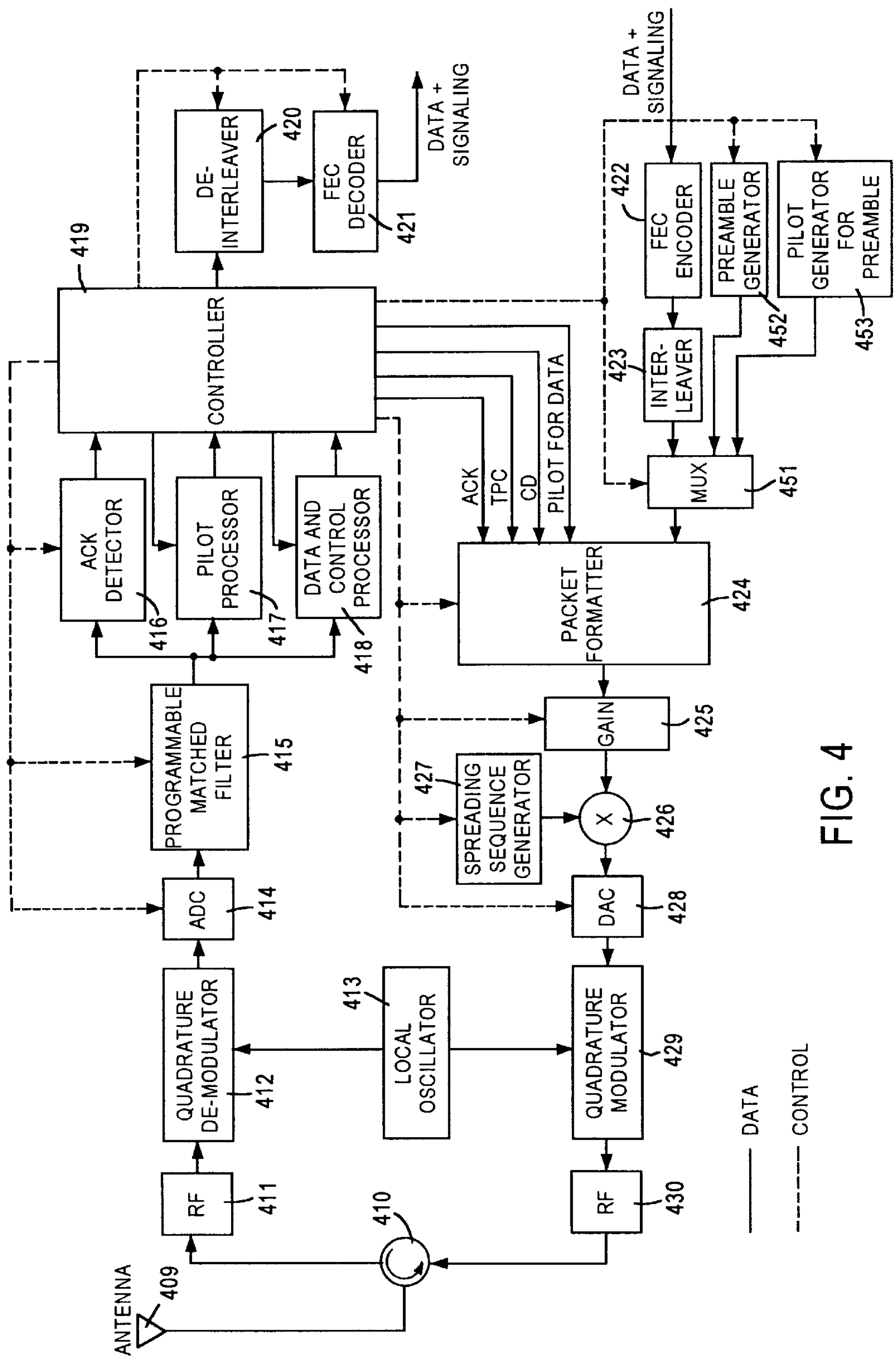
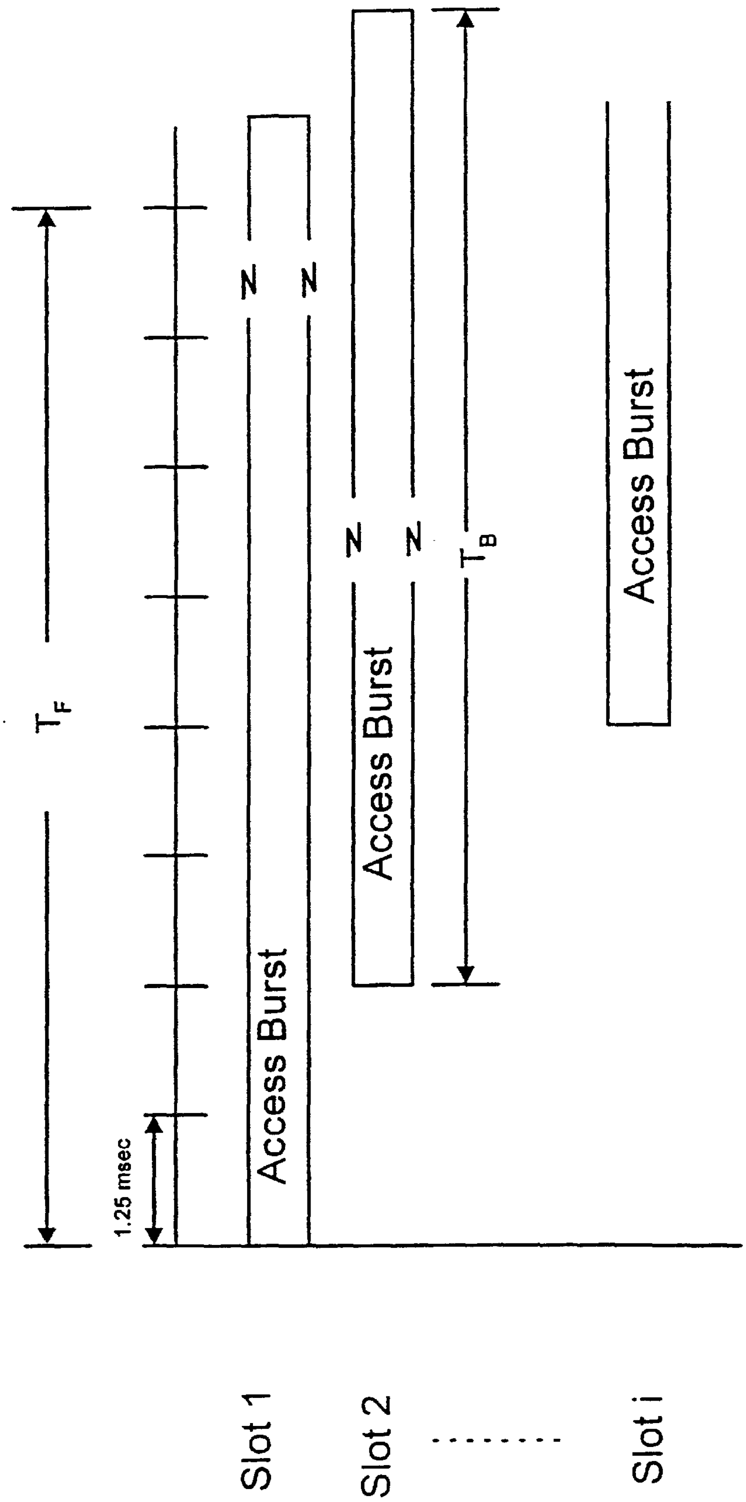
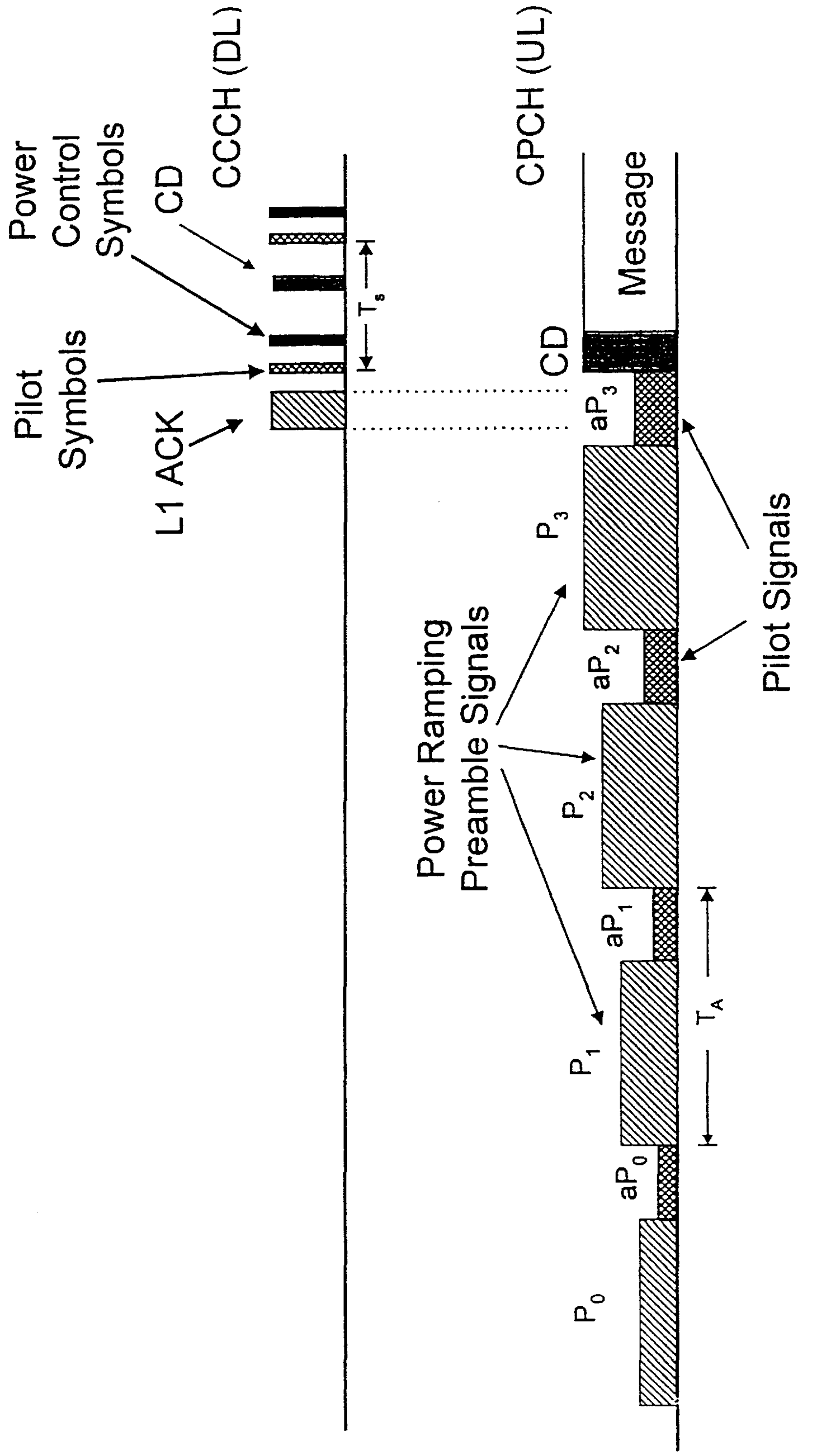

ANTENNA
409
410
RF
411
QUADRATURE DE-MODULATOR
412
LOCAL OSCILLATOR
413
ADC
414
PROGRAMMABLE MATCHED FILTER
415
ACK DETECTOR
416
PILOT PROCESSOR
417
DATA AND CONTROL PROCESSOR
418
CONTROLLER
419
DE-INTERLEAVER
420
FEC DECODER
421
DATA + SIGNALING
DATA + SIGNALING
FEC ENCODER
422
PREAMBLE GENERATOR
452
PILOT GENERATOR FOR PREAMBLE
453
INTER-LEAVER
423
MUX
451
ACK
TPC
CD
PILOT FOR DATA
PACKET FORMATTER
424
GAIN
425
SPREADING SEQUENCE GENERATOR
427
X
426
DAC
428
QUADRATURE MODULATOR
429
RF
430
DATA
CONTROL

FIG. 4



T_F
1.25 msec
Access Burst
Access Burst
T_B
Access Burst
Slot 1
Slot 2
Slot i

FIG. 5



Power Control Symbols
CD
CCCH (DL)
Pilot Symbols
L1 ACK
Ts
CPCH (UL)
Message
CD
aP3
P3
aP2
P2
aP1
P1
aP0
P0
Power Ramping Preamble Signals
Pilot Signals
TA

FIG 6

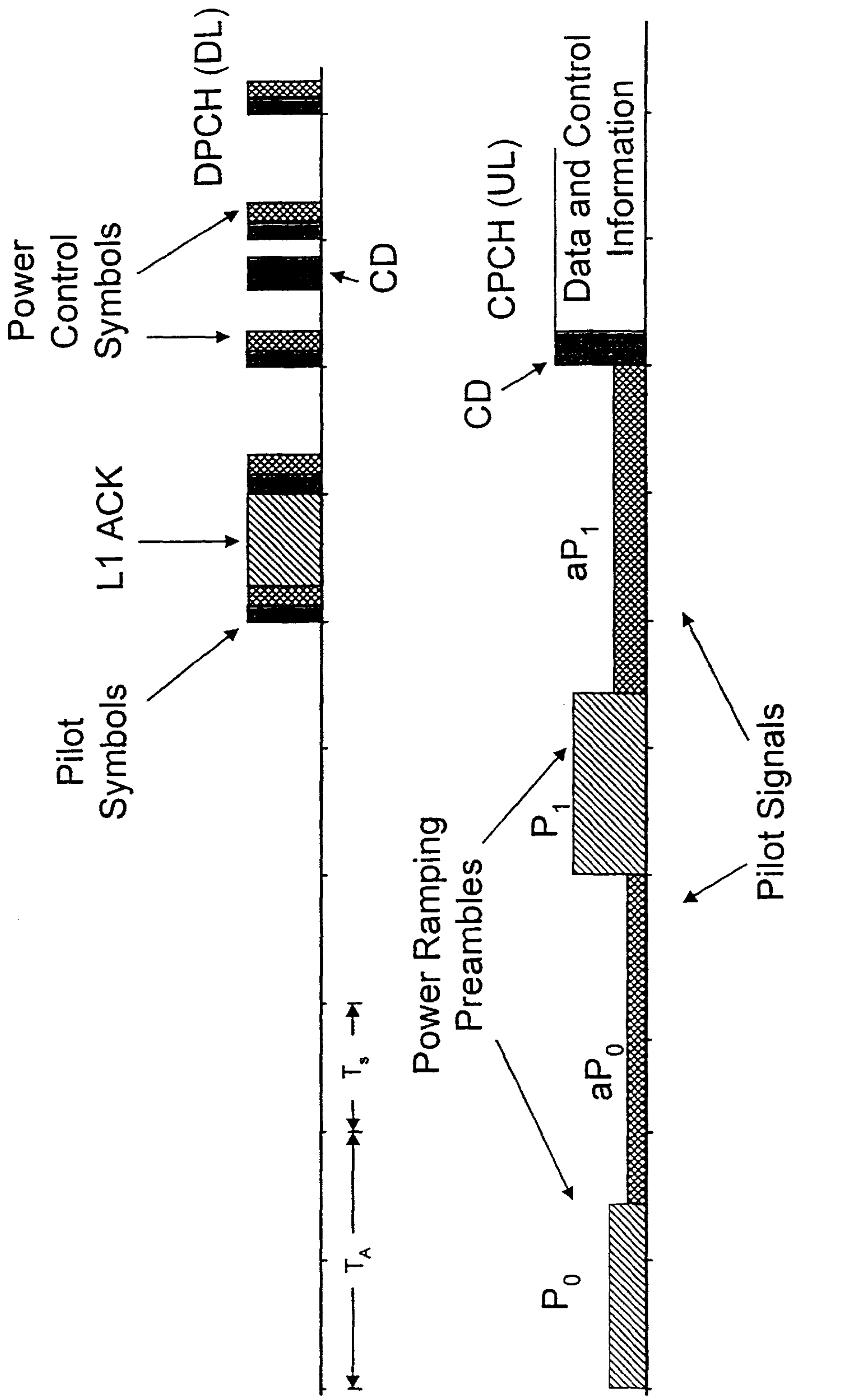

DPCH (DL)
Power Control Symbols
CD
L1 ACK
Pilot Symbols
T_A
T_s
CPCH (UL)
Data and Control Information
CD
aP_1
P_1
Power Ramping Preambles
aP_0
P_0
Pilot Signals

FIG 7

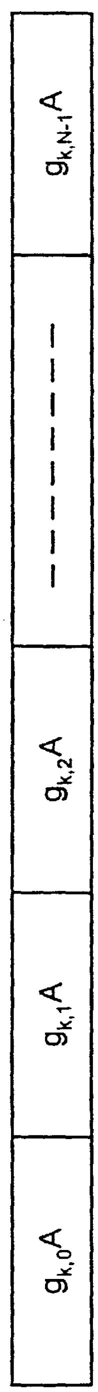
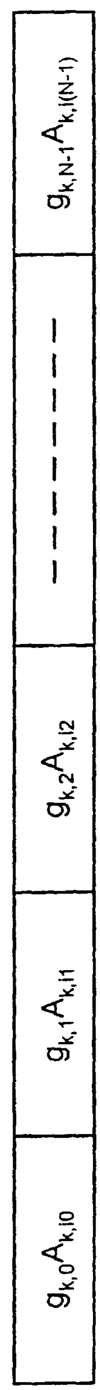


FIG 8(A)



$A_{k,ij} \in [A_0, A_1, A_2, \ldots\ldots, A_{N-1}]$

$A_{k1,ij} \neq A_{k2,ij}$

FIG 8(B)

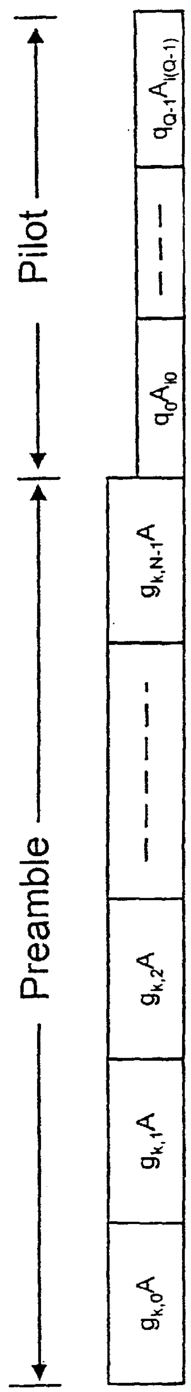
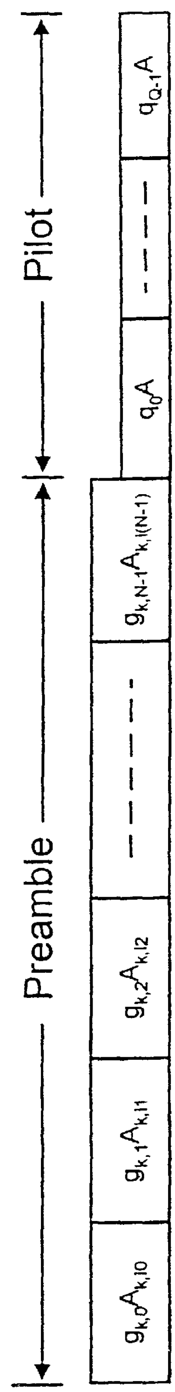


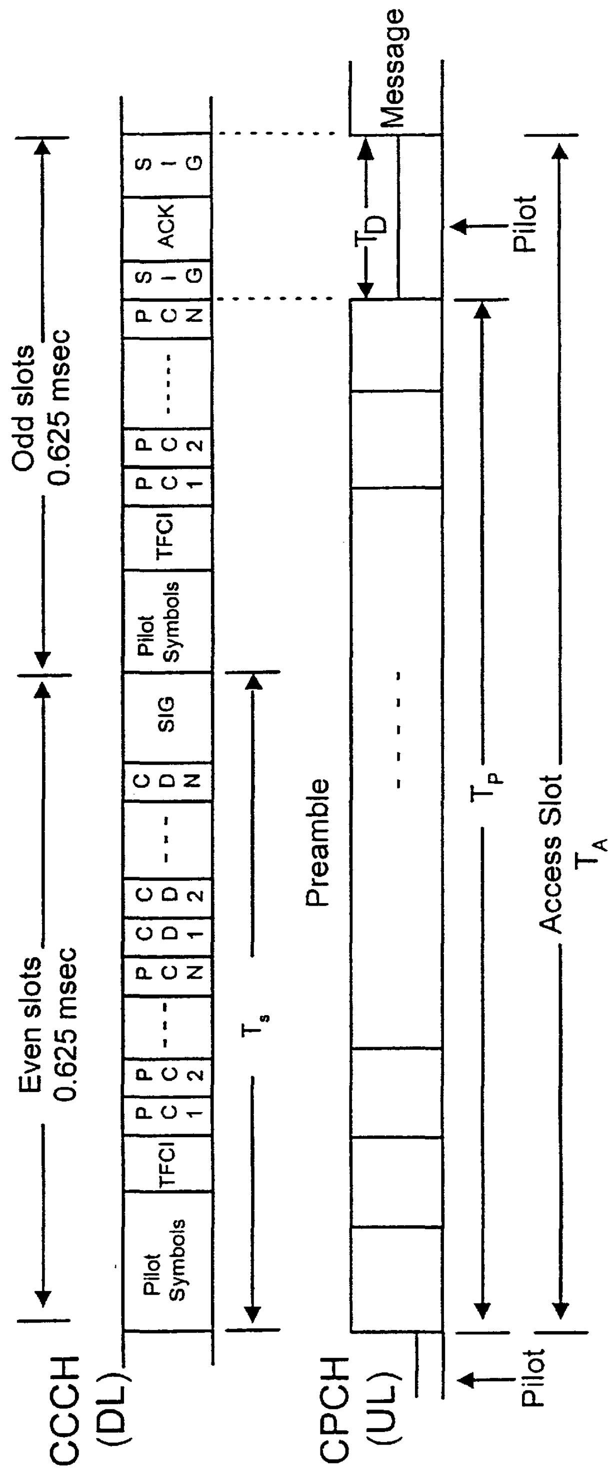
FIG 9(A)



$A_{k,ij} \in [A_0, A_1, A_2, \ldots, A_{N-1}]$

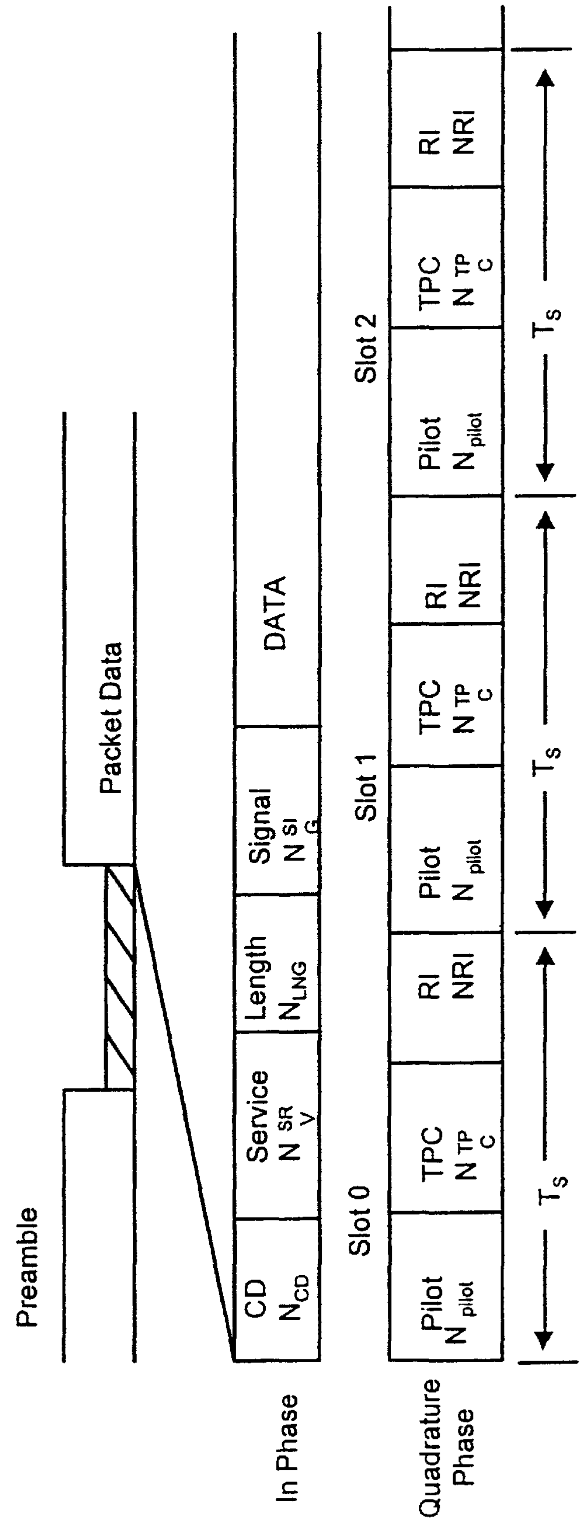
$A_{k1,ij} \neq A_{k2,ij}$

FIG 9(B)



Odd slots
0.625 msec
Even slots
0.625 msec
Pilot Symbols
TFCI
PC1
PC2
PCN
SIG
ACK
CD1
CD2
CDN
T_s
Message
T_D
Pilot
Preamble
T_P
Access Slot
T_A
CCCH
(DL)
CPCH
(UL)

FIG 10



Preamble
Packet Data
In Phase
CD N_{CD}
Service N_{SRV}
Length N_{LNG}
Signal N_{SIG}
DATA
Quadrature Phase
Slot 0
Slot 1
Slot 2
Pilot N_{pilot}
TPC N_{TPC}
RI NRI
T_S

FIG 11

RACH RAMP-UP ACKNOWLEDGEMENT

BACKGROUND OF THE INVENTION

This invention relates spread-spectrum communications, and more particularly to code-division-multiple-access (CDMA) cellular, collision detection for packet-switched systems.

DESCRIPTION OF THE RELEVANT ART

Presently proposed for a standard is a random-access burst structure which has a preamble followed by a data portion. The preamble has 16 symbols, the preamble sequence, spread by an orthogonal Gold code. A mobile station acquires chip and frame synchronization, but no consideration is given to closed-loop power control or collision detection.

An objective is to provide random channel access with reliable high data throughput and low delay on CDMA systems.

Another object of the invention is to maintain reliability for high data throughput and low delay on CDMA systems.

According to the present invention, as embodied and broadly described herein, an improvement to a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, is provided. The CDMA system has a base station (BS) and a plurality of remote stations. The base station has BS-spread-spectrum transmitter and a BS-spread-spectrum receiver. Each of the plurality of remote stations has an RS-spread-spectrum transmitter and an RS-spread-spectrum receiver. The method comprises the steps of transmitting from the BS-spread-spectrum transmitter, a broadcast common-synchronzation channel having a common chip-sequence signal common to the plurality of remote stations. The broadcast common-synchronization channel has a frame-timing signal.

At a first RS-spread-spectrum receiver, the steps further include receiving the broadcast common-synchronization channel. From the broadcast common-synchronization channel, the steps include determining frame timing at the first RS-spread-spectrum receiver from the frame-timing signal.

From a first RS-spread-spectrum transmitter, the steps include transmitting an access-burst signal. The access-burst signal has a multiple segments at different power levels, that is to say typically at sequentially increasing power levels.

The BS-spread-spectrum receiver receives at least one segment of the access burst signal at a detectable power level. In response, the BS-spread-spectrum transmitter sends an acknowledgment signal back to the first RS-spread-spectrum receiver. Receipt of the acknowledgment signal by the first RS-spread-spectrum receiver causes the RS-spread-spectrum transmitter to send data to the BS-spread-spectrum receiver. The detection of the segment at an adequate power level, acknowledgment communication and subsequent data transmission provides the remote station (RS) with random access to the channel (RACH).

The preferred embodiment also provides that when there is a collision of a first access-burst signal with a collision access-burst signal, then the BS-spread-spectrum receiver does not correctly receive the collision-detection portion of the first access-burst signal. Thus, the BS-spread-spectrum transmitter transmits to the first RS-spread-spectrum receiver, an collision-detection without reflecting the collision-detection portion. At the first RS-spread-spectrum receiver, in response to receiving the collision-detection signal without the collision detection portion, the first RS-spread-spectrum transmitter transmits to the BS-spread-spectrum receiver, a second access-burst signal.

Additional objects and advantages of the invention are set forth in part in the description which follows, and in part are obvious from the description, or may be learned by practice of the invention. The objects and advantages of the invention also may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate preferred embodiments of the invention, and together with the description serve to explain the principles of the invention.

FIG. **1** is a common packet channel system block diagram with a common control downlink channel;

FIG. **2** is common packet channel system block diagram with a dedicated downlink channel;

FIG. **3** is a block diagram of a base station receiver for common packet channel;

FIG. **4** is a block diagram of a mobile station receiver and transmitter for common packet channel;

FIG. **5** is a timing diagram for access burst transmission;

FIG. **6** illustrates common packet channel access burst of FIG. **5** using a common control downlink channel;

FIG. **7** illustrates common packet channel access of FIG. **5** using a dedicated downlink channel

FIG. **8** shows the structure of the preamble;

FIG. **9** illustrates preamble and pilot formats;

FIG. **10** is a common packet channel timing diagram and frame format of the down link common control link; and

FIG. **11** illustrates frame format of common packet channel, packet data.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference now is made in detail to the present preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals indicate like elements throughout the several views.

The common-packet channel is a new and novel uplink transport channel for transmitting variable size packets from a mobile station to a base sation within listening range, without the need to obtain a two way link with any one or set of base stations. The channel resource allocation is contention based; that is, a number of mobile stations could at any time content for the same resources, as found in an ALOHA system.

In the exemplary arrangement shown in FIG. **1**, common-packet channel provides an improvement to a code-division-multiple-access (CDMA) system employing spread-spectrum modulation. The CDMA system has a plurality of base stations (BS) **31**, **32**, **33** and a plurality of remote stations (RS). Each remote station **35** has an RS-spread-spectrum transmitter and an RS-spread-spectrum receiver. An uplink is from the remote station **35** to a base station **31**. The uplink has the common-packet channel (CPCH). A downlink is from a base station **31** to the remote station **35**, and is denoted a common-control channel (CCCH). The common-control channel has common signaling used by the plurality of remote stations.

An alternative to the common-control channel, but still using the common-packet channel, is the downlink dedicated physical channel (DPCH), shown in FIG. **2**. The dedicated downlink channel, has signaling that is used for controlling a single remote station.

As illustratively shown in FIG. **3**, a BS spread-spectrum transmitter and a BS spread-spectrum receiver is shown. The BS spread-spectrum transmitter and the BS spread-spectrum receiver are located at the base station **31**. The BS spread-spectrum receiver includes an antenna **309** coupled to a circulator **310**, a receiver radio frequency (RF) section **311**, a local oscillator **313**, a quadrature demodulator **312**, and an analog-to-digital converter **314**. The receiver RF section **311** is coupled between the circulator **310** and the quadrature demodulator **312**. The quadrature demodulator is coupled to the local oscillator **313** and to the analog to digital converter **314**. The output of the analog-to-digital converter **315** is coupled to a programmable-matched filter **315**.

A preamble processor **316**, pilot processor **317** and data-and-control processor **318** are coupled to the programmable-matched filter **315**. A controller **319** is coupled to the preamble processor **316**, pilot processor **317** and data-and-control processor **318**. A de-interleaver **320** is coupled between the controller **319** and a forward-error-correction (FEC) decoder **321**.

The BS spread-spectrum transmitter includes a forward-error-correction (FEC) encoder **322** coupled to an interleaver **323**. A packet formatter **324** is coupled to the interleaver **323** and to the controller **319**. A variable gain device **325** is coupled between the packet formatter **324** and a product device **326**. A spreading-sequence generator **327** is coupled to the product device **326**. A digital-to-analog converter **328** is coupled between the product device **328** and quadrature modulator **329**. The quadrature modulator **329** is coupled to the local oscillator **313** and a transmitter RF section **330**. The transmitter RF section **330** is coupled to the circulator **310**.

The controller **319** has control links coupled to the analog-to-digital converter **314**, programmable-matched filter **315**, preamble processor **316**, the digital-to-analog converter **328**, the spreading sequence generator **327**, the variable gain device **325**, the packet formatter **324**, the de-interleaver **320**, the FEC decoder **321**, the interleaver **323** and the FEC encoder **322**.

A received spread-spectrum signal from antenna **309** passes through circulator **310** and is amplified and filtered by receiver RF section **311**. The local oscillator **313** generates a local signal which quadrature demodulator **312** uses to demodulator in-phase and quadrature phase components of the received spread-spectrum signal. The analog-to-digital converter **314** converts the in-phase component and the quadrature-phase component to a digital signal. These functions are well known in the art, and variations to this block diagram can accomplish the same function.

The programmable-matched filter **315** despreads the received spread-spectrum signal. A correlator, as an alternative, may be used as an equivalent means for despeading the received spread-spectrum signal.

The preamble processor **316** detects the preamble portion of the received spread-spectrum signal. The pilot processor detects and synchronizes to the pilot portion of the received spread-spectrum signal. The data and control processor detects and processes the data portion of the received spread-spectrum signal. Detected data passes through the controller **319** to the de-interleaver **320** and FEC decoder **321**. Data and signaling are outputted from the FEC decoder **321**.

In the BS transmitter, data are FEC encoded by FEC encoder **322**, and interleaved by interleaver **323**. The packet formatter formats data, signaling, acknowledgment signal, collision detection signal, pilot signal and transmitting power control (TPC) signal into a packet. The packet is outputted from packet formatter, and the packet level is amplified or attenuated by variable gain device **325**. The packet is spread-spectrum processed by product device **326**, with a spreading chip-sequence from spreading-sequence generator **327**. The packet is converted to an analog signal by digital-to-analog converter **328**, and in-phase and quadrature-phase components are generated by quadrature modulator **329** using a signal from local oscillator **313**. The packet is translated to a carrier frequency, filtered and amplified by transmitter RF section **330**, and then passes through circulator **310** and is radiated by antenna **309**.

In the illustrative embodiment shown in FIG. **4**, a MS spread-spectrum transmitter and a MS spread-spectrum receiver are shown. The MS spread-spectrum transmitter and the MS spread-spectrum receiver are located at the mobile station **35**, shown in FIG. **1**. The MS spread-spectrum receiver includes an antenna **409** coupled to a circulator **410**, a receiver radio frequency (RF) section **411**, a local oscillator **413**, a quadrature demodulator **412**, and an analog-to-digital converter **414**. The receiver RF section **411** is coupled between the circulator **410** and the quadrature demodulator **412**. The quadrature demodulator is coupled to the local oscillator **413** and to the analog to digital converter **414**. The output of the analog-to-digital converter **415** is coupled to a programmable-matched filter **415**.

An acknowledgment detector **416**, pilot processor **417** and data-and-control processor **418** are coupled to the programmable-matched filter **415**. A controller **419** is coupled to the acknowledgment detector **416**, pilot processor **417** and data-and-control processor **418**. A de-interleaver **420** is coupled between the controller **419** and a forward-error-correction (FEC) decoder **421**.

The MS spread-spectrum transmitter includes a forward-error-correction (FEC encoder **422** coupled to an interleaver **423**. A packet formatter **425** is coupled through a multiplexer **424** to the interleaver **423** and to the controller **419**. A preamble generator **452** and a pilot generator **453** for the preamble are coupled to the multiplexer **451**. A variable gain device **425** is coupled between the packet formatter **424** and a product device **426**. A spreading-sequence generator **427** is coupled to the product device **426**. A digital-to-analog converter **428** is coupled between the product device **428** and quadrature modulator **429**. The quadrature modulator **429** is coupled to the local oscillator **413** and a transmitter RF section **430**. The transmitter RF section **430** is coupled to the circulator **410**.

The controller **419** has control links coupled to the analog-to-digital converter **414**, programmable-matched filter **415**, acknowledgment detector **416**, the digital-to-analog converter **428**, the spreading sequence generator **427**, the variable gain device **425**, the packet formatter **424**, the de-interleaver **420**, the FEC decoder **421**, the interleaver **423**, the FEC encoder **422**, the preamble generator **452** and the pilot generator **453**.

A received spread-spectrum signal from antenna **409** passes through circulator **410** and is amplified and filtered by receiver RF section **411**. The local oscillator **413** generates a local signal which quadrature demodulator **412** uses to demodulate in-phase and quadrature phase components of the received spread-spectrum signal. The analog-to-digital converter **414** converts the in-phase component and the

quadrature-phase component to a digital signal. These functions are well known in the art, and variations to this block diagram can accomplish the same function.

The programmable-matched filter **415** despreads the received spread-spectrum signal. A correlator, as an alternative, may be used as an equivalent means for despreading the received spread-spectrum signal.

The acknowledgment detector **416** detects an acknowledgment in the received spread-spectrum signal. The pilot processor detects and synchronizes to the pilot portion of the received spread-spectrum signal. The data and control processor detects and processes the data portion of the received spread-spectrum signal. Detected data passes through the controller **419** to the de-interleaver **420** and FEC decoder **421**. Data and signaling are outputted from the FEC decoder **421**.

In the MS transmitter, data are FEC encoded by FEC encoder **422**, and interleaved by interleaver **423**. The preamble generator **452** generates a preamble and the pilot generator **453** generates a pilot for the preamble. The multiplexer **451** multiplexes the data, preamble and pilot, and the packet formatter **424** formats the preamble, pilot and data into a common-packet channel packet. Further, the packet formatter formats data, signaling, acknowledgment signal, collision detection signal, pilot signal and TPC signal into a packet. The packet is outputted from packet formatter, and the packet level is amplified or attenuated by variable gain device **425**. The packet is spread-spectrum processed by product device **426**, with s spreading chip-sequence from spreading-sequence generator **427**. The packet is converted to an analog signal by digital-to-analog converter **428**, and in-phase and quadrature-phase components are generated by quadrature modulator **429** using a signal from local oscillator **413**.

Referring to FIG. **5**, the base station transmits a common-synchronization channel, which has a frame time duration T_F. The common-synchronization channel has a common chip-sequence signal, which is common to the plurality of remote stations communicating with the particular base station. In a particular embodiment, the time T_F of one frame is ten milliseconds. Within one frame, there are eight access slots. Each access slot lasts 1.25 milliseconds. Timing for the access slots is the frame timing, and the portion of the common-synchronization channel with the frame timing is denoted the frame-timing signal. The frame-timing signal is the timing a remote station uses in selecting an access slot in which to transmit an access-burst signal.

A first remote station attempting to access the base station, has a first RS-spread-spectrum receiver for receiving the common synchronization channel, broadcast from the base station. The first RS-spread-spectrum receiver determines frame timing from the frame-timing signal.

A first RS-spread-spectrum transmitter, located at the first remote station, transmits an access-burst signal. An access burst signal, as shown in FIG. **5**, starts at the beginning of an access slot, as defined by the frame timing portion of the common-synchronization channel.

FIG. **6** illustratively shows the common-packet channel access burst format, for each access-burst signal. Each access-burst signal has a plurality of segments. Each segment has a preamble followed by a pilot signal. The plurality of segments has a plurality of power levels, respectively. More particularly, the power level of each segment increases with each subsequent segment. Thus, a first segment has a first preamble and pilot, at a first power level P_0. A second segment has a second preamble and a second pilot, at a

second power level P_1. The third segment has a third preamble and a third pilot at a third power level P_2. The first preamble, the second preamble, the third preamble, and subsequent preambles, may be identical or different. The power level of the pilot preferably is less than the power level of the preamble. A preamble is for synchronization, and a corresponding pilot, which follows a preamble, is to keep the BS spread-spectrum receiver receiving the spread-spectrum signal from the remote station, once a preamble is detected.

A subsequent increase or decrease of power levels is basically a closed loop power control system. Once a BS spread-spectrum receiver detects a preamble from the remote station, the BS spread-spectrum transmitter sends an acknowledgment (ACK) signal.

Referring to FIG. **4**, the preamble is generated by preamble generator **452** and the pilot is generated by pilot generator **453**. A preamble format is shown in FIG. **8**. The preamble format with a pilot is shown in FIG. **9**. The multiplexer **451**, with timing from the controller **419**, selects the preamble then a corresponding pilot, for packet formatter **424**. A series of preambles and pilots may be generated and made as part of the packet by packet formatter **424**. The preambles and pilots can have their power level adjusted either in the preamble generator **452** and pilot generator **453**, or by the variable gain device **425**.

The BS spread-spectrum receiver receives the access-burst signal at a detected-power level. More particularly, the access-burst signal has the plurality of preambles at a plurality of power levels, respectively. When a preamble with sufficient power level is detected at the BS spread-spectrum receiver, then an acknowledgment (ACK) signal is transmitted from the BS spread-spectrum transmitter. The ACK signal is shown in FIG. **6**, in response to the fourth preamble having sufficient power for detection by the BS spread-spectrum receiver.

FIG. **3** shows the preamble processor **316** for detecting the preamble and the pilot processor **317** for continuing to receive the packet after detecting the preamble. Upon detecting the preamble, the processor **319** initiates an ACK signal which passes to packet formatter **324** and is radiated by the BS spread-spectrum transmitter.

The first RS-spread-spectrum receiver receives the acknowledgment signal. Upon receiving the ACK signal, the first RS-spread-spectrum transmitter transmits to the BS-spread-spectrum receiver, a spread-spectrum signal having data. The data is shown in FIG. **6**, in time, after the ACK signal. The data may include a collision detection (DC) portion of the signal, referred to herein as a collision detection signal, and message.

In response to each packet transmitted from the MS spread-spectrum transmitter, the BS receiver detects the collision detection portion of the data, and retransmits the data field of the collision detection portion of the data to the remote station. FIG. **10** shows the timing diagram for re-transmitting the collision detection field. There are several slots for collision detection retransmission, which can be used for re-transmitting the collision detection field for several remote stations. If the collision detection field were correctly re-transmitted to the remote station, then the remote station knows its packet is successfully received by the base station. If the collision detection field were not correctly re-transmitted by the base station, then the remote station assumes there is a collision with a packet transmitted by another remote station, and stops further transmission of the data. FIG. **11** shows a frame format of a common-packet channel data payload.

In operation, an overview of the way this transport mechanism is used is as follows. A remote station (RS) upon power up searches for transmission from nearby base stations. Upon successful synchronization with one or more base stations, the Remote station receives the necessary system parameters from a continuously transmitted by all base stations broadcast control channel (BCCH). Using the information transmitted from the BCCH, the remote station can determine various parameters required when first transmitting to a base station. Parameters of interest are the loading of all the base stations in the vicinity of the remote station, their antenna characteristics, spreading codes used to spread the downlink transmitted information, timing information and other control information. With this information, the remote station can transmit specific waveforms in order to capture the attention of a nearby base station. In the common packet channel the remote station, having all the necessary information from the nearby base station, it starts transmitting a particular preamble from a set of predefined preambles, at [a] well selected time intervals. The particular structure of the preamble waveforms is selected on the basis that detection of the preamble waveform at the base station is to be as easy as possible with minimal loss in detectability.

The physical common packet channel (CPCH) is used to carry the CPCH. It is based on the well known Slotted ALOHA approach. There is a number of well defined time offsets relative to the frame boundary of a downlink received BCCH channel. These time offsets define access slots. The number of access slots is chosen according to the particular application at hand. As an example, shown in FIG. **5**, eight access slots are spaced 1.25 msec apart in a frame of 10-msec duration.

According to FIG. **5**, a remote station picks an access slot in a random fashion and tries to obtain a connection with a base station by transmitting a preamble waveform. The base station is able to recognize this preamble, and is expecting its reception at the beginning of each access slot. The length of the access burst is variable and the length of the access burst is allowed to vary from a few access slots to many frame durations. The amount of data transmitted by the remote station could depend on various factors. Some of those are: class capability of the remote station, prioritization, the control information transmitted down by the base station, and various bandwidth management protocols residing and executed at the base station. A field at the beginning of the data portion signifies the length of the data.

The structure of the access burst is shown in FIG. **6**. The access burst starts with a set of preambles of duration T_P whose power is increased in time from preamble to preamble in a step-wise manner. The transmitted power during each preamble is constant. For the duration T_D between preambles the access burst consists of a pilot signal transmitted at a fixed power level ratio relative to the previously transmitted preamble. There is a one to one correspondence between the code structure of the preamble and the pilot signal. The pilot signal could be eliminated by setting it to a zero power level.

The transmission of the preambles ceases if the preamble has been picked up detected by the base station and the base station has responded to the remote station with a layer one acknowledgment L1 ACK, which the remote station has also successfully received. Alternatively, transmission of the preamble ceases if the remote station has transmitted the maximum allowed number of preambles Mp without acknowledgement. Upon receiving an L1 ACK the remote station starts transmission of its data. Once the remote station has transmitted more than Mp preambles, it undergoes a forced random back off procedure. This procedure forces the remote station to delay its access burst transmission for a later time. The random back off procedure could be parameterized based on the priority statues of the Remote station. The amount by which the power is increased from preamble to preamble is Dp which is either fixed for all cells at all times or it is repeatedly broadcast via the BCCH. Remote stations with different priority statuses could use a power increase which depends on a priority status assigned to the remote station. The priority status could be either predetermined or assigned to the remote station after negotiation with the base station.

The Preamble Signal Structure

There is a large set of possible preamble waveforms. Every base station is assigned a subset of preambles from the set of all preamble waveforms in the system. The set of preambles a base station is using is broadcast through it's BCCH channel. There are many ways of generating preamble waveforms. One existing way is to use a single orthogonal Gold code per preamble from the set of all possible orthogonal Gold codes of length L. A preamble could then be constructed by repeating the Gold code a number of times N to transmit a length N complex sequence. For example if A denotes the orthogonal Gold-code and $G_i=\{g_{i,0}\ g_{i,1}\ g_{i,2}\ \ldots\ g_{i,N-1}\}$, a length N complex sequence, then a preamble could be formed as shown in FIG. **8**, where, $g_{i,j}$, j=0, . . . , N−1, multiplies every element in A. Normally the sets of G_i's are chosen to be orthogonal to each other. This will allow for a maximum of N possible waveforms. The total number of possible preambles is then L*N.

The preferred approach is to use different codes rather than a single repeating code in generating each preamble. In that case, if L possible codes, not necessarily Gold Codes, were possible, designated by $A_0, A_1, \ldots A_{L-1}$, then possible preambles will be as shown in FIG. **8**. The order of the A_i's can be chosen so that identical codes are not used in the same locations for two different preambles. A similar approach could be used to form the pilot signals.

The Downlink Common Control Channel

In FIG. **10**, the downlink common control channel structure for even and odd slots is shown. The even slots contain reference data and control data. The pilot symbols are used to derive a reference for demodulating the remaining control symbols. The control symbols are made of transport frame indicator (TFI) symbols, power control (PC) symbols, collision detection (CD) symbol and signaling symbols (SIG). The odd slots contain all the information that the even slots contain plus an acknowledgment (ACK) signal. Odd slots do not include collision detection fields.

The uplink CPCH is shown over the last transmitted preamble. After the last transmitted preamble, the base station has successfully detected the transmission of the last transmitted preamble and transmits back the acknowledgment signal. During the same time, the remote station is tuned to receive the ACK signal. The ACK signal transmitted corresponds to the specific preamble structure transmitted on the uplink. Once the remote station detects the ACK signal corresponding to transmitted preamble by the remote station, the remote station begins transmission of its data.

Corresponding with the preamble structure in the uplink there is a corresponding in time power control information symbol and a corresponding in time collision detection field. Upon start of data transmission the remote station uses the downlink transmitted power control information to adjust its

transmitted power. The power control symbols are decoded to derive binary decision data, which is then used to increase or decrease the transmitted power accordingly. FIG. 11 shows the structure of the uplink frame and the slot format for the data portion of the uplink transmission. Data and control information is transmitted in an in-phase and quadrature-phase multiplexed format. That is, the data portion could be transmitted on the in-phase coordinate and the control portion on the quadrature-phase coordinate. The modulation for the data and control is BPSK. The control channel may contain the information for the receiver to enable the demodulation of the data. The control channel provides for upper layer system functionality. The data portion consists of one or more frames. Each frame consists of a number of slots. As an example the frame duration could be 10 milliseconds long and the slot duration 0.625 milliseconds long. In that case, there are 16 slots per frame. The beginning of the data payload contains a collision detection field used to relay information about the possibility of collision with other simultaneously transmitting remote stations. The collision detection field is read by the base station. The base station expects the presence of the collision detection field since it had provided an ACK signal at the last time slot.

The collision detection field includes a temporary identification (ID) number chosen at random by the mobile for the transmission of the current packet. The base station reads the collision detection field and reflects, or transmits back, the collision detection field on the downlink. If the collision detection field detected by the remote station matched the one just being transmitted by the same remote station, then the collision detection field is an identification that the transmission is being received correctly. The remote station then continues transmitting the remaining of the packet. In case the collision detection field has not been received correctly by the remote station, then the remote station considers the packet reception by the base station as erroneous and discontinues transmission of the remaining packet.

The function of the remaining fields are as follows. The Pilot field enables the demodulation of both the data and control bits. The transmitted power control (TPC) bits are used to control the power of a corresponding downlink channel, in case a down link channel directed to the same user is operational. If the downlink channel were not operational, then the TPC control bits can be used to relay additional pilot bits instead.

The Rate Information (RI) field is used to provide the transmitter with the ability to change its data rate without the necessity to explicitly negotiate the instantaneous data rate with the base station. The service field provides information of the particular service the data bits are to be used for. The length field specifies the time duration of the packet. The signal field can be used to provide additional control information as required.

Additional functionalities of the common packet channel are: (1) bandwidth management and (2) L2 acknowledgment mechanism.

The bandwidth management functionality is implemented via signaling information on the down link common control channel. There are three ways for incorporating this functionality. The first relies on changing the priority status of all uplink users, which currently are transmitting information using the CPCH. By this method all the users are remapping their priority status via a control signal sent at the downlink. When the priority of the CPCH users is lowered their ability to capture an uplink channel is lowered. Thus the amount of data sent on the uplink by the CPCH users is thus reduced. The other mechanism is for the base station to relay the maximum possible data rate the CPCH users are allowed to transmit. This prevents the CPCH users from transmitting at a rate which could possibly exceed the uplink system capacity and therefore take the cell down, i.e., disrupt the communication for all users currently connected to the base station. For the third method, the base station could provide a negative acknowledgment through the ACK signal. In this case, any remote station which is tuned to receive the ACK signal is prohibited from further transmission of an access-burst signal.

The L2 acknowledgment (L2 ACK) mechanism, which is different than the L1 ACK, is used by the base station to notify the remote station for the correctness of an uplink packet reception. The base station could either relay to the remote station which portions of the packet have being received correctly or which have being received incorrectly. There are many existing ways of implementing a particular protocol to relay this type of information. For example, the packet could be identified as consisting of a number of frames, with each frame consisting of a number of sub-frames. The frames are identified by a predetermined number. The sub-frames in each frame are also identified by a specific number. One way for the base to relay the information about the correctness of the packet is to identify all the frames and sub-frames that have been received correctly. Another way is to identify the frames and sub-frames that have been received in error. The way the base station could identify the correctness of a frame or sub-frame is by checking its cyclic residue code (CRC) field. Other more robust mechanisms for acknowledgment may be used.

CD Operation

There are many remote stations that might try to access the base station at the same time. There is a number of different preamble signals which a remote station can use for reaching the base station. Each remote station chooses at random one of the preamble signals to use for accessing the base station. The base station transmits a broadcast common synchronization channel. This broadcast common synchronization channel includes a frame timing signal. The remote stations extract the frame timing transmitted by the base station by receiving the broadcast common synchronization channel. The frame timing is used by the remote stations to derive a timing schedule by dividing the frame duration in a number of access slots. The remote stations are allowed to transmit their preambles only at the beginning of each access slot. The actual transmit times for different remote stations could be slightly different due to their different propagation delays. This defines an access protocol commonly known as the slotted ALOHA access protocol. Each remote station repeatedly transmits its preamble signal until the base station detects the preamble, acknowledges that the preamble is received, and the acknowledgment is correctly received by the remote station. There could be more than one remote station transmitting the same preamble signal in the same access slot. The base station cannot recognize if two or more remote stations were transmitting the same preamble in the same access slot. When the base station detects the transmission of a preamble signal, it transmits back an acknowledgment message. There is one acknowledgment message corresponding to each possible preamble signal. Therefore, the are as many acknowledgment messages as there are preamble signals. Every transmitting remote station which receives an acknowledgment message corresponding to its

transmitting preamble signal, will start transmitting its message. For each preamble signal, there is a corresponding spreading code used by the base station to transmit the message. The message transmission always starts at the beginning of an access slot. Since there could be a number of remote stations using the same preamble signal in the same access slot, they start transmitting their message at the same time using the same spreading code. In that case, the transmissions of the remote stations likely interferes with each other and thus is not received correctly.

Each remote station includes a collision detection (CD) field in the beginning of the transmitted message. The CD field is chosen at random by each remote station and independently from each other Remote Station. There is a predefined limited number of CD fields. Two remote stations transmitting their message at the same time most likely chose a different CD field. When the base station receives the CD field, the base station reflects back, transmits back, the CD field to the remote station. The remote station reads the reflected CD field by the base station. If the reflected CD field matched the the CD field the remote station transmitted, the the remote station assumes that the remote station is being received correctly by the base station and continue transmitting the rest of the message, or data. If the reflected CD field from the base station did not match the one transmitted by the remote station, then the remote station assumes that there has been a collision and stops transmitting the remaining message or data.

It will be apparent to those skilled in the art that various modifications can be made to the collision detection system of the instant invention without departing from the scope or spirit of the invention, and it is intended that the present invention cover modifications and variations of the collision detection system provided they come within the scope of the appended claims and their equivalents.

We claim:

1. An improvement to a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a first base station (BS) with a first BS-spread-spectrum transmitter and a first BS-spread-spectrum receiver, a second base station with a second BS-spread-spectrum transmitter and a second BS-spread-spectrum receiver, and a plurality of remote stations, with each remote station (RS) having an RS-spread-spectrum transmitter and an RS-spread-spectrum receiver, the method comprising the steps of:

transmitting from said first BS-spread-spectrum transmitter located at said first base station, a first broadcast common-synchronization channel having a first common chip-sequence signal common to the plurality of remote stations, the first broadcast common-synchronization channel having a first frame-timing signal;

transmitting from said second BS-spread-spectrum transmitter located at said second base station, a second broadcast common-synchronization channel having a second common chip-sequence signal common to the plurality of remote stations, the second broadcast common-synchronization channel having a second frame-timing signal;

receiving at a first RS-spread-spectrum receiver the first broadcast common-synchronization channel, and determining a first frame timing at said first RS-spread-spectrum receiver from the first frame-timing signal;

receiving at the first RS-spread-spectrum receiver the second broadcast common-synchronization channel, and determining a second frame timing at said first RS-spread-spectrum receiver from the second frame-timing signal;

determining, based on any of power levels and probabilities of error, at said first RS-spread-spectrum receiver, from the first broadcast common-synchronization channel and from the second broadcast common-synchronization channel, to transmit to said first base station;

transmitting from a first RS-spread-spectrum transmitter to said first base station, a first access-burst signal;

receiving at said first BS-spread-spectrum receiver the first access-burst signal at a first detected-power level;

transmitting from said first BS-spread-spectrum transmitter to said first RS-spread-spectrum receiver, responsive to the first access-burst signal, a first acknowledgment signal;

receiving at said first RS-spread-spectrum receiver the first acknowledgment signal; and

transmitting from said first RS-spread-spectrum transmitter, responsive to the first acknowledgment signal, to said first BS-spread-spectrum receiver, a first spread-spectrum signal having data.

2. The improvement as set forth in claim **1**, further including the step of transmitting from said first RS-spread-spectrum transmitter, any of data and control information, to said BS-spread-spectrum receiver.

3. The improvement as set forth in claim **1** with the step of transmitting from the first RS-spread-spectrum transmitter the first access-burst signal, including the step of transmitting the first access-burst signal with a first plurality of segments having a first plurality of power levels increasing sequentially, respectively.

4. The improvement as set forth in claim **1**, further including the steps of:

determining, based on any of power levels and probabilities of error, at said first RS-spread-spectrum receiver, from the first broadcast common-synchronization channel and from the second broadcast common-synchronization channel, to transmit to said second base station;

transmitting from the first RS-spread-spectrum transmitter to said second base station, a second access-burst signal;

receiving at said second BS-spread-spectrum receiver the second access-burst signal at a second detected-power level;

transmitting from said second BS-spread-spectrum transmitter to said first RS-spread-spectrum receiver, responsive to the second access-burst signal, a second acknowledgment signal;

receiving at said first RS-spread-spectrum receiver the second acknowledgment signal; and

transmitting from said first RS-spread-spectrum transmitter, responsive to the second acknowledgment signal, to said second BS-spread-spectrum receiver, a second spread-spectrum signal having data.

5. The improvement as set forth in claim **4**, further including the step of transmitting from said second RS-spread-spectrum transmitter, any of data and control information, to said BS-spread-spectrum receiver.

6. The improvement as set forth in claim **4** with the step of transmitting from the first RS-spread-spectrum transmitter the second access-burst signal, including the step of transmitting the second access-burst signal with a second

plurality of segments having a second plurality of power levels increasing sequentially, respectively.

7. An improvement to a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a first base station (BS), a second base station, and a plurality of remote stations (RS) with each remote station having an RS-spread-spectrum transmitter and an RS-spread-spectrum receiver, the improvement comprising:

a first BS-spread-spectrum transmitter located at said first base station, for transmitting a first broadcast common-synchronization channel having a first common chip-sequence signal common to the plurality of remote stations, the first broadcast common-synchronization channel having a first frame-timing signal;

a second BS-spread-spectrum transmitter located at said second base station, for transmitting a second broadcast common-synchronization channel having a second common chip-sequence signal common to the plurality of remote stations, the second broadcast common-synchronization channel having a second frame-timing signal;

a first RS-spread-spectrum receiver, located at a first remote station of the plurality of remote stations, for receiving the first broadcast common-synchronization channel, and determining first frame timing at said first RS-spread-spectrum receiver from the first frame-timing signal;

said first RS-spread-spectrum receiver for receiving the second broadcast common-synchronization channel, and determining a second frame timing at said first RS-spread-spectrum receiver from the second frame-timing signal;

means, based on any of power levels and probabilities of error, located at said first RS-spread-spectrum receiver, for determining from the first broadcast common-synchronization channel and from the second broadcast common-synchronization channel, to transmit to said first base station;

a first RS-spread-spectrum transmitter, located at said first remote station of said plurality of remote stations, for transmitting a first access-burst signal;

said first BS-spread-spectrum receiver for receiving the access-burst signal at a detected-power level;

said first BS-spread-spectrum transmitter for transmitting to said first RS-spread-spectrum receiver, responsive to receiving the first access-burst signal, a first acknowledgment signal;

said first RS-spread-spectrum receiver for receiving the first acknowledgment signal; and

said first RS-spread-spectrum transmitter, responsive to the first acknowledgment signal, for transmitting to said first BS-spread-spectrum receiver, a first spread-spectrum signal having data.

8. The improvement as set forth in claim **7**, with said first RS-spread-spectrum transmitter for transmitting any of data and control information, to said BS-spread-spectrum receiver.

9. The improvement as set forth in claim **8** with said first RS-spread-spectrum transmitter for transmitting the first access-burst signal with a first plurality of segments having a first plurality of power levels increasing sequentially, respectively.

10. The improvement as set forth in claim **7**, further including:

said means for determining, based on any of power levels and probabilities of error, at said first RS-spread-spectrum receiver, from the first broadcast common-synchronization channel and from the second broadcast common-synchronization channel, to transmit to said second base station;

said first RS-spread-spectrum transmitter for transmitting to said second base station, a second access-burst signal;

said second BS-spread-spectrum receiver for receiving the second access-burst signal at a second detected-power level;

said second BS-spread-spectrum transmitter for transmitting to said first RS-spread-spectrum receiver, responsive to the second access-burst signal, a second acknowledgment signal;

said first RS-spread-spectrum receiver for receiving the second acknowledgment signal; and

said first RS-spread-spectrum transmitter, responsive to the second acknowledgment signal, for transmitting to said second BS-spread-spectrum receiver, a second spread-spectrum signal having data.

11. The improvement as set forth in claim **10** with said first RS-spread-spectrum transmitter for transmitting the second access-burst signal with a second plurality of segments having a second plurality of power levels increasing sequentially, respectively.

12. The improvement as set forth in claim **10**, with said second RS-spread-spectrum transmitter for transmitting any of data and control information, to said BS-spread-spectrum receiver.

13. A base-band processor, for use in a code-division-multiple-access (CDMA) wireless base station having a modulator and a demodulator, the base-band processor comprising:

a preamble processor, coupled to the demodulator, for detecting a preamble in a received spread-spectrum signal;

a data processor, coupled to the demodulator, for detecting and processing any data contained in the received spread-spectrum signal;

an encoder, for encoding data;

an interleaver, coupled to the encoder, for interleaving encoded data;

packet a packet formatter, coupled to the interleaver, for formatting the interleaved data into a packet; and

a controller coupled to the preamble processor and coupled for controlling the modulator, the data processor and the packet formatter, such that in operation the base-band processor is for performing the following steps:

detecting a first one of a sequence of coded preamble signals embedded in a first spread-spectrum signal received at an adequate power level;

upon detection of the first coded preamble signal at the adequate power level, generating a packet comprising an acknowledgement signal, and outputting the packet comprising the acknowledgement signal to the modulator; and

processing a packet, comprising data, from a second received spread-spectrum signal.

14. The base-band processor as set forth in claim **13**, wherein:

the base-band processor further comprises the demodulator of the CDMA wireless base station; and

the demodulator is for demodulating a received spread-spectrum signal.

15. The base-band processor as set forth in claim **14**, wherein the demodulator comprises:

an analog-to-digital converter for converting received spread-spectrum signals from an antenna to a digital signal; and

means responsive to the digital signal from the analog-to-digital converter for despreading the received spread-spectrum signals and detecting the transmitted data.

16. The base-band processor as set forth in claim **13**, further comprising a digital to analog converter responsive to digital signals from the packet formatter.

17. The base-band processor as set forth in claim **13**, further comprising a variable gain device, coupled to the packet formatter, for adjusting the level of packets from the packet formatter before application thereof to the modulator.

18. A base-band processor, for use in a code-division-multiple-access (CDMA) wireless handset having a spread-spectrum modulator and a spread-spectrum demodulator, the base-band processor, comprising:

an acknowledgment detector, coupled to the demodulator, for detecting an acknowledgment in a received spread-spectrum signal;

an encoder, for encoding data;

an interleaver, coupled to the encoder, for interleaving encoded data;

a preamble generator for generating a preamble;

a multiplexer, coupled to the interleaver and to the preamble generator, for multiplexing the interleaved data and the preamble;

a packet formatter, coupled to the multiplexer, for formatting the multiplexed data and preamble into one or more packets; and

a controller coupled to the acknowledgment detector and coupled for controlling the modulator, the preamble generator, the multiplexer and the packet formatter, such that in operation the base-band processor is for performing the following steps:

generating and outputting to the modulator a plurality of packets comprising a sequence of coded preamble signals at sequentially increasing discrete power levels;

detecting an acknowledgement in a received spread-spectrum signal; and

upon detection of the acknowledgement, outputting a packet comprising data to the modulator for transmission over a random access wireless channel.

19. The base-band processor as set forth in claim **18**, wherein:

the base-band processor further comprises the demodulator of the CDMA wireless handset; and

the demodulator is for demodulating a received spread-spectrum signal.

20. The base-band processor as set forth in claim **19**, wherein the demodulator comprises:

an analog-to-digital converter for converting received spread-spectrum signals from an antenna to a digital signal; and

means responsive to the digital signal from the analog-to-digital converter for despreading the received spread-spectrum signals and detecting transmitted data.

21. The base-band processor as set forth in claim **18**, further comprising a digital to analog converter responsive to digital signals from the packet formatter.

22. The base-band processor as set forth in claim **18**, further comprising a variable gain device, coupled to the packet formatter, for adjusting the level of packets from the packet formatter before application thereof to the modulator.

23. A method of operation of a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a base station (BS) with a BS-spread-spectrum transmitter and a BS-spread-spectrum receiver, and a plurality of remote stations, with each remote station (RS) having an RS-spread spectrum transmitter and an RS-spread-spectrum receiver, the method comprising the steps of:

transmitting a broadcast common-synchronization channel, from the BS-spread-spectrum transmitter located at the base station to the plurality of remote stations;

receiving at a first RS-spread-spectrum receiver the broadcast common-synchronization channel, and determining a plurality of parameters required for transmission to the base station;

transmitting from a first RS-spread-spectrum transmitter a first preamble at a first discrete power level;

if no acknowledgment corresponding to the previously transmitted preamble is received at the first RS-spread-spectrum receiver by a time following the transmission of the first preamble, transmitting from the first RS-spread-spectrum transmitter a second preamble at a second discrete power level that is higher than the first discrete power level;

receiving the second preamble, at a detected-power level, at the BS-spread-spectrum receiver;

transmitting an acknowledgment of the received preamble from the BS-spread-spectrum transmitter;

receiving the acknowledgment at the first RS-spread-spectrum receiver; and

transmitting a spread-spectrum signal having data from the first RS-spread spectrum transmitter to the BS-spread-spectrum receiver, responsive to the receipt of the acknowledgment.

24. A method of communication through a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a base station (BS) with a BS-spread-spectrum transmitter and a BS-spread-spectrum receiver, and a plurality of remote stations, with each remote station (RS) having an RS-spread spectrum transmitter and an RS-spread-spectrum receiver, the method comprising the steps of:

receiving a broadcast common-synchronization channel from the BS-spread-spectrum transmitter located at the RS-spread-spectrum receiver of one of the remote stations, and determining a plurality of parameters required for transmission to the base station;

transmitting a preamble at a discrete power level from the RS-spread-spectrum transmitter of the one remote station;

listening for an acknowledgment corresponding to the transmitted preamble at the RS-spread-spectrum receiver of the one remote station;

if an acknowledgment is not received, upon expiration of a predetermined interval, following the transmission of the preamble, increasing power level to a new discrete power level, and repeating the transmitting step and continuing the listening step;

upon receiving an acknowledgment at the RS-spread-spectrum receiver of the one remote station, ceasing preamble transmission and transmitting a spread-spectrum signal having data from the RS-spread-spectrum transmitter of the one remote station, for the BS-spread-spectrum receiver.

25. The method of claim **24**, wherein:

the steps of transmitting the preamble and listening for the acknowledgement repeat up to a maximum number of times; and

if no acknowledgment corresponding to the transmitted preamble has been received after the maximum number of repetitions, the one remote station ceases preamble transmission for a period, before resuming the steps of transmitting the preamble and listening for the acknowledgement.

26. The method of claim **24**, wherein if the steps of transmitting the preamble and listening for the acknowledgement repeat a plurality of times, the increasing of the power level to a new discrete power level will repeat until power level reaches a maximum value.

27. A method of transferring packet data for a mobile station (MS) with an MS receiver and an MS transmitter, comprising:

receiving at the MS receiver a broadcast common channel from a base station;

determining a plurality of parameters required for transmission to the base station;

spreading an access preamble selected from a set of predefined preambles;

transmitting from the MS transmitter the spread access preamble, at a first discrete power level;

if NO acknowledgement corresponding to the access preamble is detected, transmitting a spread access preamble from the MS transmitter at a second discrete power level higher than the first discrete power level; and

upon detecting an acknowledgement corresponding to a transmitted access preamble, ceasing preamble transmission and transmitting the packet data from the MS transmitter.

28. The method of claim **27**, further comprising one or more additional steps of transmitting a spread access preamble at a successively higher power if NO acknowledgement corresponding to any of the preamble transmissions is received, up to a maximum allowed number of preamble transmissions.

29. A code-division-multiple-access (CDMA) wireless handset, comprising:

a CDMA transmitter;

a CDMA receiver; and

a controller coupled to the CDMA receiver for responding to signals received via the CDMA receiver and coupled for controlling the CDMA transmitter, such that in operation the CDMA handset is for performing the following steps:

spreading an access preamble selected from a set of predefined preambles;

transmitting the spread access preamble, at a first discrete power level to a base station;

if NO acknowledgement corresponding to the access preamble is detected, transmitting a spread access preamble from the MS transmitter at a second discrete power level higher than the first discrete power level; and

upon detecting an acknowledgement corresponding to a transmitted access preamble, ceasing preamble transmission and transmitting packet data from the MS transmitter.

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(12) **EX PARTE REEXAMINATION CERTIFICATE** (7241st)

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(54) **RACH-RAMP-UP ACKNOWLEDGEMENT**

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H04B 7/26 (2006.01)

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(58) **Field of Classification Search** .... None
See application file for complete search history.

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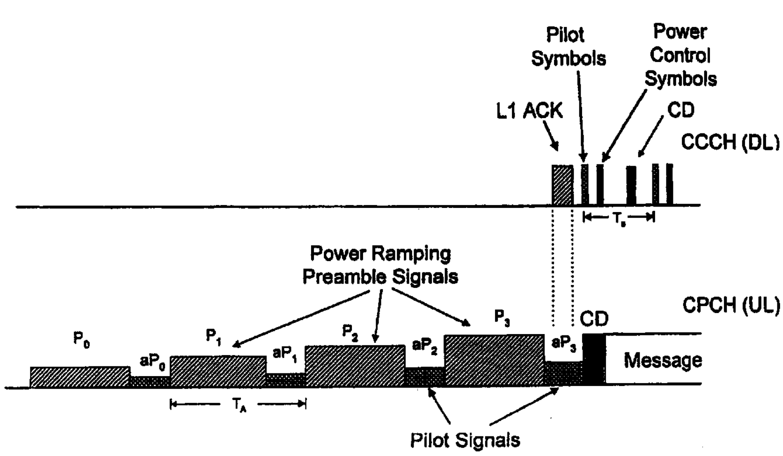
Primary Examiner—Charles Craver

(57) **ABSTRACT**

An improvement to a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a base station (BS) with a BS-spread-spectrum transmitter and a BS-spread-spectrum receiver, and a plurality of remote stations. Each remote station (RS) has an RS-spread-spectrum transmitter and an RS-spread-spectrum receiver. The improvement includes the steps of transmitting from the BS-spread-spectrum transmitter, a broadcast common-synchronization channel. The broadcast common-synchronization channel has a common chip-sequence signal common to the plurality of remote stations, and a frame-timing signal. The improvement includes receiving at a first RS-spread-spectrum receiver the broadcast common-synchronization channel, and determining frame timing from the frame-timing signal, and transmitting from a first RS-spread-spectrum transmitter an access-burst signal. The access-burst signal has a plurality of segments, which have a plurality of power levels. At the BS-spread-spectrum receiver the access-burst signal is received at a detected-power level. In response to receiving the access-burst signal, the BS-spread-spectrum transmitter transmits to the first RS-spread-spectrum receiver an acknowledgment signal. The first RS-spread-spectrum receiver receives the acknowledgment signal, and in response to receiving the acknowledgment signal, the first RS-spread-spectrum transmitter transmits to the BS-spread-spectrum receiver, a spread-spectrum signal having data.



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EX PARTE REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307

NO AMENDMENTS HAVE BEEN MADE TO THE PATENT

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims **1**–**12** and **27**–**29** is confirmed.

Claims **13**–**26** are cancelled.

New claims **30**–**60** are added and determinded to be patentable.

30. An improvement to a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a first base station (BS) with a first BS-spread-spectrum transmitter and a first BS-spread-spectrum receiver, a second base station with a second BS-spread-spectrum transmitter and a second BS-spread-spectrum receiver, and a plurality of remote stations, with each remote station (RS) having an RS-spread-spectrum transmitter and an RS-spread-spectrum receiver, the method comprising the steps of:

transmitting from said first BS-spread-spectrum transmitter located at said first base station, a first broadcast common-synchronization channel having a first common chip-sequence signal common to the plurality of remote stations, the first broadcast common-synchronization channel having a first frame-timing signal;

transmitting from said second BS-spread-spectrum transmitter located at said second base station, a second broadcast common-synchronization channel having a second common chip-sequence signal common to the plurality of remote stations, the second broadcast common-synchronization channel having a second frame-timing signals;

receiving at a first RS-spread-spectrum receiver the first broadcast common-synchronization channel, and determining a first frame timing at said first RS-spread-spectrum receiver from the first frame-timing signal;

receiving at the first RS-spread-spectrum receiver the second broadcast common-synchronization channel, and determining a second frame timing at said first RS-spread-spectrum receiver from the second frame-timing signal;

determining, based on any of power levels and probabilities of error, at said first RS-spread-spectrum receiver, from the first broadcast common-synchronization channel and from the second broadcast common-synchronization channel, to transmit to said first base station;

transmitting from a first RS-spread-spectrum transmitter to said first base station, a first access-burst signal;

receiving at said first BS-spread-spectrum receiver the first access-burst signal at a first detected-power level;

transmitting from said first BS-spread-spectrum transmitter to said first RS-spread-spectrum receiver, responsive to the first access-burst signal, a first layer one acknowledgment signal;

receiving at said first RS-spread-spectrum receiver the first layer one acknowledgment signal; and

transmitting from said first RS-spread-spectrum transmitter, responsive to the first layer one acknowledgment signal, to said first BS-spread-spectrum receiver, a first spread-spectrum signal having data.

31. The improvement as set forth in claim 30, further including the step of transmitting from said first RS-spread-spectrum transmitter, any of data and control information, to said first BS-spread-spectrum receiver.

32. The improvement as set forth in claim 30, with the step of transmitting from the first RS-spread-spectrum transmitter the first access-burst signal, including the step of transmitting the first access-burst signal with a first plurality of segments having a first plurality of power levels increasing sequentially, respectively.

33. The improvement as set forth in claim 30, further including the steps of: determining, based on any of power levels and probabilities of error, at said first RS-spread-spectrum receiver, from the first broadcast common-synchronization channel and from the second broadcast common-synchronization channel, to transmit to said second base station;

transmitting from the first RS-spread-spectrum transmitter to said second base station, a second access-burst signal;

receiving at said second BS-spread-spectrum receiver the second access-burst signal at a second detected-power level;

transmitting from said second BS-spread-spectrum transmitter to said first RS-spread-spectrum receiver, responsive to the second access-burst signal, a second layer one acknowledgment signal;

receiving at said first RS-spread-spectrum receiver the second layer one acknowledgment signal; and

transmitting from said first RS-spread-spectrum transmitter, responsive to the second layer one acknowledgment signal, to said second BS-spread-spectrum receiver, a second spread-spectrum signal having data.

34. The improvement as set forth in claim 33, further including the step of transmitting from said second RS-spread-spectrum transmitter, any of data and control information, to second said BS-spread-spectrum receiver.

35. The improvement as set forth in claim 33, with the step of transmitting from the first RS-spread-spectrum transmitter the second access-burst signal, including the step of transmitting the second access-burst signal with a second plurality of segments having a second plurality of power levels increasing sequentially, respectively.

36. An improvement to a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a first base station (BS), a second base station, and a plurality of remote stations, with each remote station (RS) having an RS-spread-spectrum transmitter and an RS-spread-spectrum receiver, the improvement comprising:

a first BS-spread-spectrum transmitter located at said first base station, for transmitting a first broadcast common-synchronization channel having a first common chip-sequence signal common to the plurality of remote stations, the first broadcast common-synchronization channel having a first frame-timing signal;

a second BS-spread-spectrum transmitter located at said second base station, for transmitting a second broadcast common-synchronization channel having a second common chip-sequence signal common to the plurality of remote stations, the second broadcast common-synchronization channel having a second frame-timing signal;

a first RS-spread-spectrum receiver, located at a first remote station of the plurality of remote stations, for receiving the first broadcast common-synchronization channel, and determining first frame timing at said first RS-spread-spectrum receiver from the first frame-timing signal;

said first RS-spread-spectrum receiver for receiving the second broadcast common-synchronization channel, and determining a second frame timing at said first RS-spread-spectrum receiver from the second frame-timing signal;

means, based on any of power levels and probabilities of error, located at said first RS-spread-spectrum receiver, for determining from the first broadcast common-synchronization channel and from the second broadcast common-synchronization channel, to transmit to said first base station;

a first RS-spread-spectrum transmitter, located at said first remote station of said plurality of remote stations, for transmitting a first access-burst signal;

said first BS-spread-spectrum receiver for receiving the access-burst signal at a detected-power level;

said first BS-spread-spectrum transmitter for transmitting to said first RS-spread-spectrum receiver, responsive to receiving the first access-burst signal, a first layer one acknowledgment signal;

said first RS-spread-spectrum receiver for receiving the first layer one acknowledgment signal; and

said first RS-spread-spectrum transmitter, responsive to the first layer one acknowledgment signal, for transmitting to said first BS-spread-spectrum receiver, a first spread-spectrum signal having data.

37. The improvement as set forth in claim 36, with said first RS-spread-spectrum transmitter for transmitting any of data and control information, to said BS-spread-spectrum receiver.

38. The improvement as set forth in claim 37, with said first RS-spread-spectrum transmitter for transmitting the first access-burst signal with a first plurality of segments having a first plurality of power levels increasing sequentially, respectively.

39. The improvement as set forth in claim 36, further including: said means for determining, based on any of power levels and probabilities of error, at said first RS-spread-spectrum receiver, from the first broadcast common-synchronization channel and from the second broadcast common-synchronization channel, to transmit to said second base station;

said first RS-spread-spectrum transmitter for transmitting to said second base station, a second access-burst signal;

said second BS-spread-spectrum receiver for receiving the second access-burst signal at a second detected-power level;

said second BS-spread-spectrum transmitter for transmitting to said first RS-spread-spectrum receiver, responsive to the second access-burst signal, a second layer one acknowledgment signal;

said first RS-spread-spectrum receiver for receiving the second layer one acknowledgment signal; and

said first RS-spread-spectrum transmitter, responsive to the second layer one acknowledgment signal, for transmitting to said second BS-spread-spectrum receiver, a second spread-spectrum signal having data.

40. The improvement as set forth in claim 39, with said first RS-spread-spectrum transmitter for transmitting the second access-burst signal with a second plurality of segments having a second plurality of power levels increasing sequentially, respectively.

41. The improvement as set forth in claim 39, with said second RS-spread-spectrum transmitter for transmitting any of data and control information, to said second BS-spread-spectrum receiver.

42. A method of transferring packet data for a mobile station (MS) with an MS receiver and an MS transmitter, comprising:

receiving at the MS receiver a broadcast common channel from a base station;

determining a plurality of parameters required for transmission to the base station;

spreading an access preamble selected from a set of predefined preambles;

transmitting from the MS transmitter the spread access preamble, at a first discrete power level;

if no layer one acknowledgement corresponding to the access preamble is detected, transmitting a spread access preamble from the MS transmitter at a second discrete power level higher than the first discrete power level; and

upon detecting a layer one acknowledgement corresponding to a transmitted access preamble, ceasing preamble transmission and transmitting the packet data from the MS transmitter.

43. The method of claim 42, further comprising one or more additional steps of transmitting a spread access preamble at a successively higher power if no layer one acknowledgement corresponding to any of the preamble transmissions is received, up to a maximum allowed number of preamble transmissions.

44. A code-division-multiple-access (CDMA) wireless handset, comprising:

a CDMA transmitter;

a CDMA receiver; and

a controller coupled to the CDMA receiver for responding to signals received via the CDMA receiver and coupled for controlling the CDMA transmitter, such that in operation the CDMA handset is for performing the following steps:

spreading an access preamble selected from a set of predefined preambles;

transmitting the spread access preamble, at a first discrete power level to a base station;

if no layer one acknowledgement corresponding to the access preamble is detected, transmitting a spread access preamble from the MS transmitter at a second discrete power level higher than the first discrete power level; and

upon detecting a layer one acknowledgement corresponding to a transmitted access preamble, ceasing preamble transmission and transmitting packet data from the MS transmitter.

45. The improvement as set forth in claim 1, further including the step of: selecting one of a plurality of preambles assigned to said first base station; wherein:

the first access-burst signal comprises the selected one of the preambles assigned to said first base station; and

the first layer one acknowledgment signal is a layer one acknowledgement signal corresponding to the selected one of the preambles assigned to said first base station.

46. The improvement as set forth in claim 7, wherein:

the first access-burst signal comprises a preamble selected from among a plurality of preambles assigned to said first base station; and

the first layer one acknowledgment signal is a layer one acknowledgement signal corresponding to the selected one of the preambles assigned to said first base station.

47. A base-band processor, for use in a code-division-multiple-access (CDMA) wireless base station having a modulator and a demodulator, the base-band processor comprising:

a preamble processor, coupled to the demodulator, for detecting a preamble in a received spread-spectrum signal;

a data processor, coupled to the demodulator, for detecting and processng any data contained in the received spread-spectrum signal;

an encoder, for encoding data; an interleaver, coupled to the encoder, for interleaving encoded data; packet a packet formatter, coupled to the interleaver, for formatting the interleaved data into a packet; and

a controller coupled to the preamble processor and coupled for controlling the modulator, the data processor and the packet formatter, such that in operation the base-band processor is for performing the following steps:

detecting a first one of a sequence of coded preamble signals embedded in a first spread-spectrum signal received at an adequate power level;

upon detection of the first coded preamble signal at the adequate power level, generating a packet comprising an acknowledgement signal, and outputting the packet comprising the acknowledgement signal to the modulator; and

processing a packet, comprising data, from a second received spread-spectrum signal, wherein:

the first coded preamble comprises one preamble from among a plurality of preambles assigned to said base station; and

the first layer one acknowledgment signal is a layer one acknowledgement signal corresponding to the one preamble from among the plurality of preambles assigned to said base station.

48. A base-band processor, for use in a code-division-multiple-access (CDMA) wireless handset having a spread-spectrum modulator and a spread-spectrum demodulator, the base-band processor, comprising:

an acknowledgment detector, coupled to the demodulator, for detecting an acknowledgment in a received spread-spectrum signal;

an encoder, for encoding data;

an interleaver, coupled to the encoder, for interleaving encoded data;

a preamble generator for generating a preamble;

a multiplexer, coupled to the interleaver and to the preamble generator, for multiplexing the interleaved data and the preamble;

a packet formatter, coupled to the multiplexer, for formatting the multiplexed data and preamble into one or more packets; and

a controller coupled to the acknowledgment detector and coupled for controlling the modulator, the preamble generator, the multiplexer and the packet formatter, such that in operation the base-band processor is for performing the following steps:

generating and outputting to the modulator a plurality of packets comprising a sequence of coded preamble signals at sequentially increasing discrete power levels;

detecting an acknowledgement in a received spread-spectrum signal; and

upon detection of the acknowledgement, outputting a packet comprising data to the modulator for transmission over a random access wireles channel, wherein:

each of the coded preamble signals contains a preamble selected from among a plurality of preambles assigned to a base station; and

the detected layer one acknowledgement corresponds to a preamble selected from among the plurality of preambles assigned to said base station contained in one of the coded preamble signals.

49. A method of operation of a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a base station (BS) with a BS-spread-spectrum transmitter and a BS-spread-spectrum receiver, and a plurality of remote stations, with each remote station (RS) having an RS-spread spectrum transmitter and an RS-spread-spectrum receiver, the method comprising the steps of:

transmitting a broadcast common-synchronization channel, from the BS-spread-spectrum transmitter located at the base station to the plurality of remote stations;

receiving at a first RS-spread-spectrum receiver the broadcast common-synchronization channel, and determining a plurality of parameters required for transmission to the base station;

transmitting from a first RS-spread-spectrum transmitter a first preamble at a first discrete power level;

if no acknowledgment corresponding to the previously transmitted preamble is received at the first RS-spread-spectrum receiver by a time following the transmission of the first preamble, transmitting from the first RS-spread-spectrum transmitter a second preamble at a second discrete power level that is higher than the first discrete power level;

receiving the second preamble, at a detected-power level, at the BS-spread-spectrum receiver;

transmitting an acknowledgment of the received preamble from the BS-spread-spectrum transmitter;

receiving the acknowledgment at the first RS-spread-spectrum receiver; and

transmitting a spread-spectrum signal having data from the first RS-spread spectrum transmitter to the BS-spread-spectrum receiver, responsive to the receipt of the acknowledgment, wherein:

each transmitted preamble comprises a preamble selected from among a plurality of preambles assigned to said base station; and

the layer one acknowledgement corresponds to said received preamble.

50. A method of communication through a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a base station (BS) with a BS-spread-spectrum transmitter and a BS-spread-spectrum receiver, and a plurality of remote stations, with each remote station (RS) having an RS-spread spectrum transmitter and an RS-spread-spectrum receiver, the method comprising the steps of:

receiving a broadcast common-synchronization channel from the BS-spread-spectrum transmitter located at the

RS-spread-spectrum receiver of one of the remote stations, and determining a plurality of parameters required for transmission to the base station;

transmitting a preamble at a discrete power level from the RS-spread-spectrum transmitter of the one remote station;

listening for an acknowledgment corresponding to the transmitted preamble at the RS-spread-spectrum receiver of the one remote station;

if an acknowledgment is not received, upon expiration of a predetermined interval, following the transmission of the preamble, increasing power level to a new discrete power level, and repeating the transmitting step and continuing the listening step;

upon receiving an acknowledgment at the RS-spread-spectrum receiver of the one remote station, ceasing preamble transmission and transmitting a spread-spectrum signal having data from the RS-spread-spectrum transmitter of the one remote station, for the BS-spread-spectrum receiver, wherein:

each preamble transmission comprises a preamble selected from among a plurality of preambles assigned to said base station; and

the layer one acknowledgement corresponds to a transmitted preamble.

51. The method of claim 27, wherein each spread access preamble comprises a preamble selected from among a plurality of preambles assigned to said base station.

52. The CDMA wireless handset of claim 29, wherein each spread access preamble comprises preamble selected from among a plurality of preambles assigned to said base station.

53. The improvement as set forth in claim 30, further including the step of:

selecting one of a plurality of preambles assigned to said first base station; wherein:

the first access-burst signal comprises the selected one of the preambles assigned to said first base station; and

the first layer one acknowledgment signal is a layer one acknowledgement signal corresponding to the selected one of the preambles assigned to said first base station.

54. The improvement asset forth in claim 36, wherein: the first access-burst signal comprises a preamble selected from among a plurality of preambles assigned to said first base station; and

the first layer one acknowledgment signal is a layer one acknowledgement signal corresponding to the selected one of the preambles assigned to said first base station.

55. A base-band processor, for use in a code-division-multiple-access (CDMA) wireless base station having a modulator and a demodulator, the base-band processor comprising:

a preamble processor, coupled to the demodulator, for detecting a preamble in a received spread-spectrum signal;

a data processor, coupled to the demodulator, for detecting and processing any data contained in the received spread-spectrum signal;

an encoder, for encoding data;

an interleaver, coupled to the encoder, for interleaving encoded data;

a packet formatter, coupled to the interleaver, for formatting the interleaved data into a packet; and

a controller coupled to the preamble processor and coupled for controlling the modulator, the data processor and the packet formatter, such that in operation the base-band processor is for performing the following steps:

detecting a first one of a sequence of coded preamble signals embedded in a first spread-spectrum signal received at an adequate power level;

upon detection of the first coded preamble signal at the adequate power level, generating a packet comprising a layer one acknowledgement signal, and outputting the packet comprising the layer one acknowledgement signal to the modulator; and

processing a packet, comprising data, from a second received spread-spectrum signal, wherein:

the first coded preamble comprises one preamble from among a plurality of preambles assigned to said base station; and

the first layer one acknowledgment signal is a layer one acknowledgement signal corresponding to the one preamble from among the plurality of preambles assigned to said base station.

56. A base-band processor, for use in a code-division-multiple-access (CMDA) wireless handset having a spread-spectrum modulator and a spread-spectrum demodulator, the base-band processor, comprising:

an acknowledgment detector, coupled to the demodulator, for detecting a layer one acknowledgment in a received spread-spectrum signal;

an encoder, for encoding data;

an interleaver, coupled to the encoder, for interleaving encoded data;

a preamble generator for generating a preamble;

a multiplexer, coupled to the interleaver and to the preamble generator, for multiplexing the interleaved data and the preamble;

a packet formatter, coupled to the multiplexer, for formatting the multiplexed data and preamble into one or more packets; and

a controller coupled to the acknowledgment detector and coupled for controlling the modulator, the preamble generator, the multiplexer and the packet formatter, such that in operation the base-band processor is for performing the following steps:

generating and outputting to the modulator a plurality of packets comprising a sequence of coded preamble signals at sequentially increasing discrete power levels;

detecting a layer one acknowledgement in a received spread-spectrum signal; and

upon detection of the layer one acknowledgement, outputting a packet comprising data to the modulator for transmission over a random access wireless channel, wherein:

each of the coded preamble signals contains a preamble selected from among a plurality of preambles assigned to a base station; and

the detected layer one acknowledgement corresponds to a preamble selected from among the plurality of preambles assigned to said base station contained in one of the coded preamble signals.

57. A method of operation of a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a base station (BS) with a BS-spread-spectrum transmitter and a BS-spread-spectrum receiver, and a plurality of remote stations, with each remote station (RS) having an RS-spread

spectrum transmitter and an RS-spread-spectrum receiver, the method comprising the steps of:

transmitting a broadcast common-synchronization channel, from the BS-spread-spectrum transmitter located at the base station to the plurality of remote stations;

receiving at a first RS-spread-spectrum receiver the broadcast common-synchronization channel, and determining a plurality of parameters required for transmission to the base station;

transmitting from a first RS-spread-spectrum transmitter a first preamble at a first discrete power level;

if no layer one acknowledgment corresponding to the previously transmitted preamble is received at the first RS-spread-spectrum receiver by a time following the transmission of the first preamble, transmitting from the first RS-spread-spectrum transmitter a second preamble at a second discrete power level that is higher than the first discrete power level;

receiving the second preamble, at a detected-power level, at the BS-spread-spectrum receiver;

transmitting a layer one acknowledgment of the received preamble from the BS-spread-spectrum transmitter;

receiving the layer one acknowledgment at the first RS-spread-spectrum receiver; and

transmitting a spread-spectrum signal having data from the first RS-spread spectrum transmitter to the BS-spread-spectrum receiver, responsive to the receipt of the layer one acknowledgment, wherein:

each transmitted preamble comprises a preamble selected from among a plurality of preambles assigned to said base station; and

the layer one acknowledgement corresponds to said received preamble.

58. A method of communication through a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a base station (BS) with a BS-spread-spectrum transmitter and a BS-spread-spectrum receiver, and a plurality of remote stations, with each remote station (RS) having an RS-spread spectrum transmitter and an RS-spread-spectrum receiver, the method comprising the steps of:

receiving a broadcast common-synchronization channel from the BS-spread-spectrum transmitter located at the RS-spread-spectrum receiver of one of the remote stations, and determining a plurality of parameters required for transmission to the base station;

transmitting a preamble at a discrete power level from the RS-spread-spectrum transmitter of the one remote station;

listening for a layer one acknowledgment corresponding to the transmitted preamble at the RS-spread-spectrum receiver of the one remote station;

if a layer one acknowledgment is not received, upon expiration of a predetermined interval, following the transmission of the preamble, increasing power level to a new discrete power level, and repeating the transmitting step and continuing the listening step; and

upon receiving a layer one acknowledgment at the RS-spread-spectrum receiver of the one remote station, ceasing preamble transmission and transmitting a spread-spectrum signal having data from the RS-spread-spectrum transmitter of the one remote station, for the BS-spread-spectrum receiver, wherein:

each preamble transmission comprises a preamble selected from among a plurality of preambles assigned to said base station; and

the layer one acknowledgement corresponds to a transmitted preamble.

59. The method of claim 42, wherein each spread access preamble comprises a preamble selected from among a plurality of preambles assigned to said base station.

60. The CDMA wireless handset of claim 44, wherein each spread access preamble comprises preamble selected from among a plurality of preambles assigned to said base station.

* * * * *

US007359427B2

(12) **United States Patent**
Kanterakis et al.

(10) **Patent No.: US 7,359,427 B2**
(45) **Date of Patent: Apr. 15, 2008**

(54) **RACH RAMP-UP ACKNOWLEDGEMENT**

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(51) **Int. Cl.**
H04B 1/00 (2006.01)
H04B 1/216 (2006.01)

(52) **U.S. Cl.** **375/141**; 370/335

(58) **Field of Classification Search** 375/362–368, 375/144–148, 130, 140, 141, 377, 259, 143, 375/149, 152; 370/328, 335, 342, 345, 347, 370/442, 445, 218, 525–529, 503, 278, 441; 455/515, 450, 516, 509, 517, 513, 500

See application file for complete search history.

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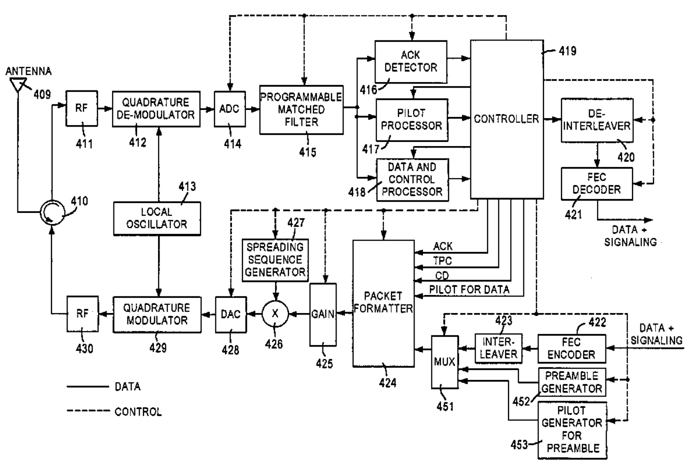
(57) **ABSTRACT**

An improvement to a code-division-multiple-access (CDMA) system employing spread-spectrum modulation, with the CDMA system having a base station (BS) and a plurality of remote stations. The base station has a BS-spread-spectrum transmitter and a BS-spread-spectrum receiver. A remote station has an RS-spread-spectrum transmitter and an RS-spread-spectrum receiver. The BS transmitter transmits a broadcast common-synchronization channel, which includes a frame-timing signal. The broadcast common-synchronization channel has a common chip-sequence signal, which is common to the plurality of remote stations. In response to the RS-spread-spectrum receiver receiving the broadcast common-synchronization channel, and determining frame timing from the frame-timing signal, an RS-spread-spectrum transmitter transmits an access-burst signal. The access-burst signal includes a collision-detection portion. In response to the BS-spread-spectrum receiver receiving the access-burst signal, the BS-spread-spectrum transmitter transmits an collision-detection signal with the collision detection portion. In response to the BS-spread-spectrum receiver not receiving the access-burst signal due to a collision with a collision access-burst signal, the BS-spread-spectrum transmitter transmits an collision-detection signal without the correct collision detection portion.

38 Claims, 11 Drawing Sheets



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'267 Invaladity Chart- "Performance Evaluation of Different Random-Access Power-Ramping Schemes", Golden Bridge Technology, Inc. v. Nokia Inc and Lucent Technologies Inc, U.S.D.Ct., E.D. Texas Marshall Division, Civil Action No. 2-05CV-151-LED.
'267 Inavalidity Chart-"A Proposal for Access Channel Structure and Procedures", Golden Bridge Technology, Inc. v. Nokia Inc and Lucent Technologies Inc, U.S.D.Ct., E.D. Texas Marshall Division, Civil Action No. 2-05CV-151-LED.
'267 Invalidity Chart-TDoc SMCG2 UMTS-Li 533/98 ("533/98"), Golden Bridge Technology, Inc. v. Nokia Inc and Lucent Technologies Inc, U.S.D.Ct., E.D. Texas Marshall Division, Civil Action No. 2-05CV-151-LED.
'267 Invalidity Chart- "Report on the Random Access Ad Hoc Meeting", Golden Bridge Technology, Inc. v. Nokia Inc and Lucent Technologies Inc, U.S.D.Ct., E.D. Texas Marshall Division, Civil Action No. 2-05CV-151-LED.
'267 Invalidity Chart-629/98, Golden Bridge Technology, Inc. v. Nokia Inc and Lucent Technologies Inc, U.S.D.Ct., E.D. Texas Marshall Division, Civil Action NO. 2-05CV-151-LED.

'267 Invalidity Chart-ETSI UTRA Candidate Submission, Golden Bridge Technology, Inc. v. Nokia Inc Lucent Technologies Inc, U.S.D.Ct., E.D. Texas Marshall Division, Civil Action No. 2-05CV-151-LED.

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'267 Invalidity Chart-U.S. Patent No. 6,587,672 ("Chuah"), Golden Bridge Technology, Inc. v. Nokia Inc and Lucent technologies Inc, U.S.D.Ct., E.D. Texas Marshall Divison, Civil Action No. 2-05CV-151-LED.

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'267 Invalidity Chart-"Modification of the Current RACH Scheme for Increased Throughout".

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'267 Invalidity Chart-"Power Ramping RACH Transmission for UTRAN", Golden Bridge Technology, Inc. v. Noikia Inc and Lucent Technologies Inc, U.S.D.Ct., E.D. Texas Marshall Division, Civil Action No. 2-05CV-151-LED.

Reply Brief for Plaintiff-Appellant, filed on Oct. 29, 2007, with the United States Court of Appeals for the Circuit Court, Appeal No. 2007-1215.

Brief of Defendant-Appellee Lucent Technologies, Inc. filed on Oct. 3, 2007, with the United States Court of Appeals for the Circuit Court, Appeal No. 2007-1215.

Brief for Plaintiff-Appellant filed on Jul. 23, 2007, with the United States Court of Appeals for the Federal Circuit, Appeal No. 2007-1215.

* cited by examiner

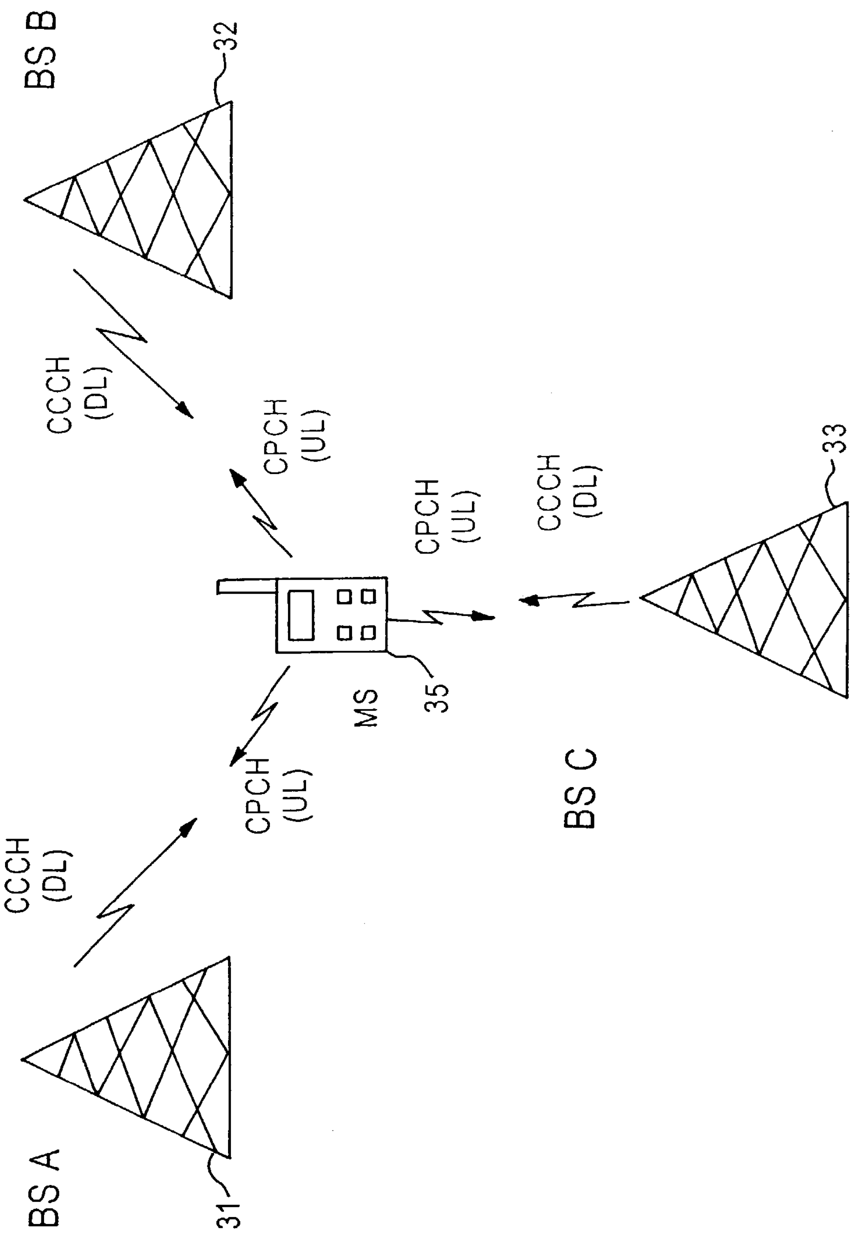

BS B
32
CCCH (DL)
CPCH (UL)
CPCH (UL)
CCCH (DL)
33
MS
35
CPCH (UL)
BS C
CCCH (DL)
BS A
31

FIG. 1

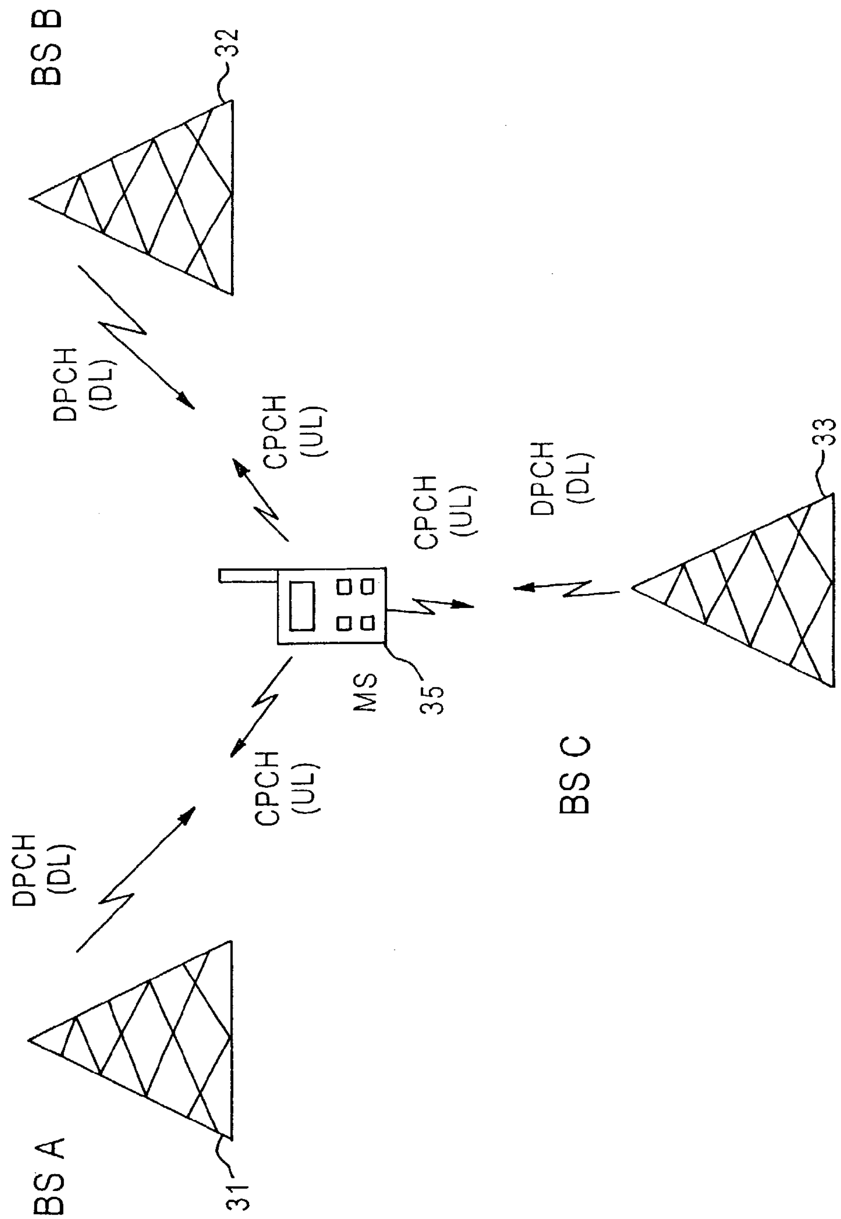

BS B
32
DPCH (DL)
CPCH (UL)
CPCH (UL)
DPCH (DL)
33
MS
35
CPCH (UL)
BS C
DPCH (DL)
BS A
31

FIG. 2

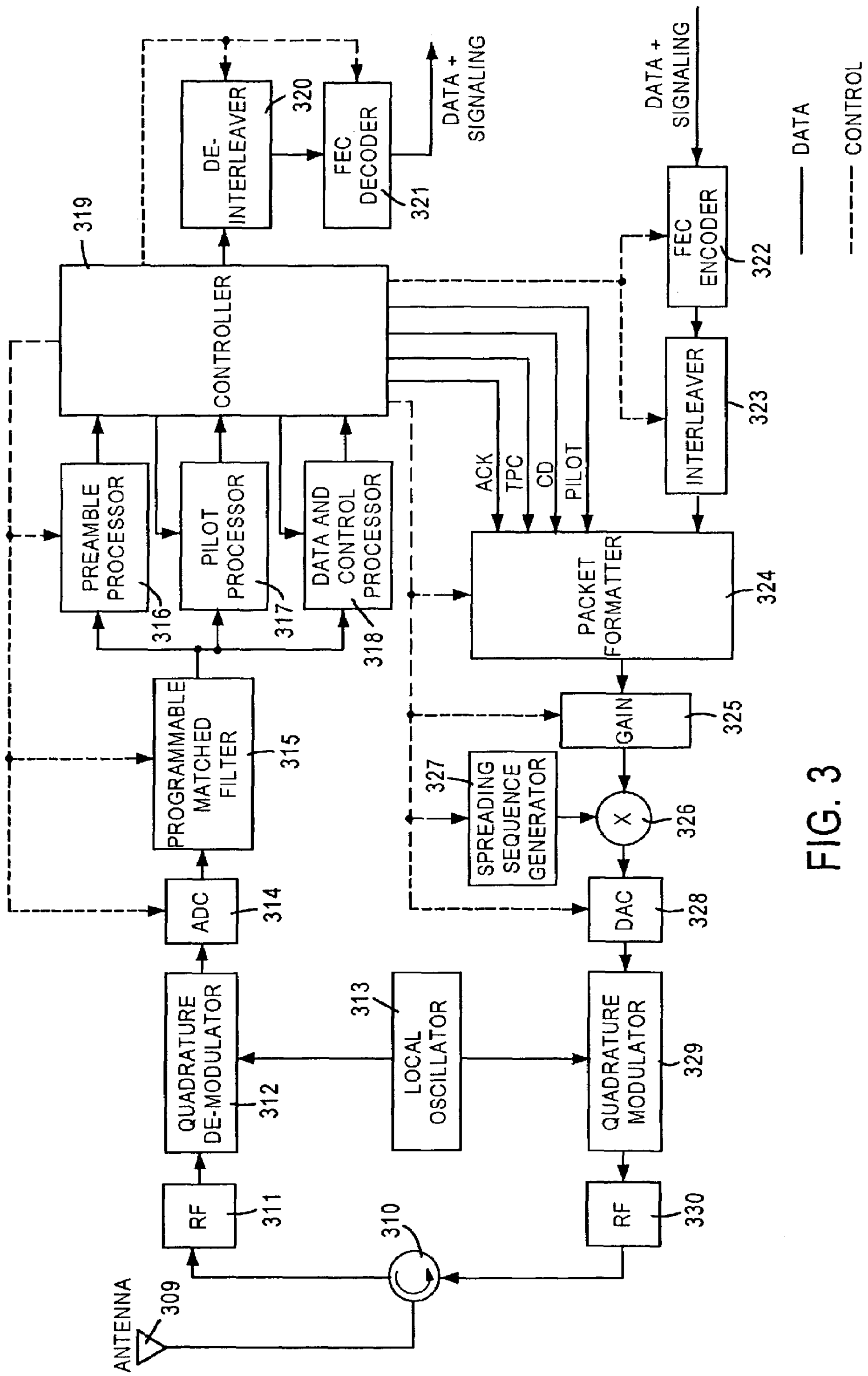

ANTENNA
309
310
RF
311
QUADRATURE DE-MODULATOR
312
LOCAL OSCILLATOR
313
ADC
314
PROGRAMMABLE MATCHED FILTER
315
PREAMBLE PROCESSOR
316
PILOT PROCESSOR
317
DATA AND CONTROL PROCESSOR
318
CONTROLLER
319
DE-INTERLEAVER
320
FEC DECODER
321
DATA + SIGNALING
DATA + SIGNALING
FEC ENCODER
322
INTERLEAVER
323
ACK
TPC
CD
PILOT
PACKET FORMATTER
324
GAIN
325
326
SPREADING SEQUENCE GENERATOR
327
DAC
328
QUADRATURE MODULATOR
329
RF
330
DATA
CONTROL

FIG. 3

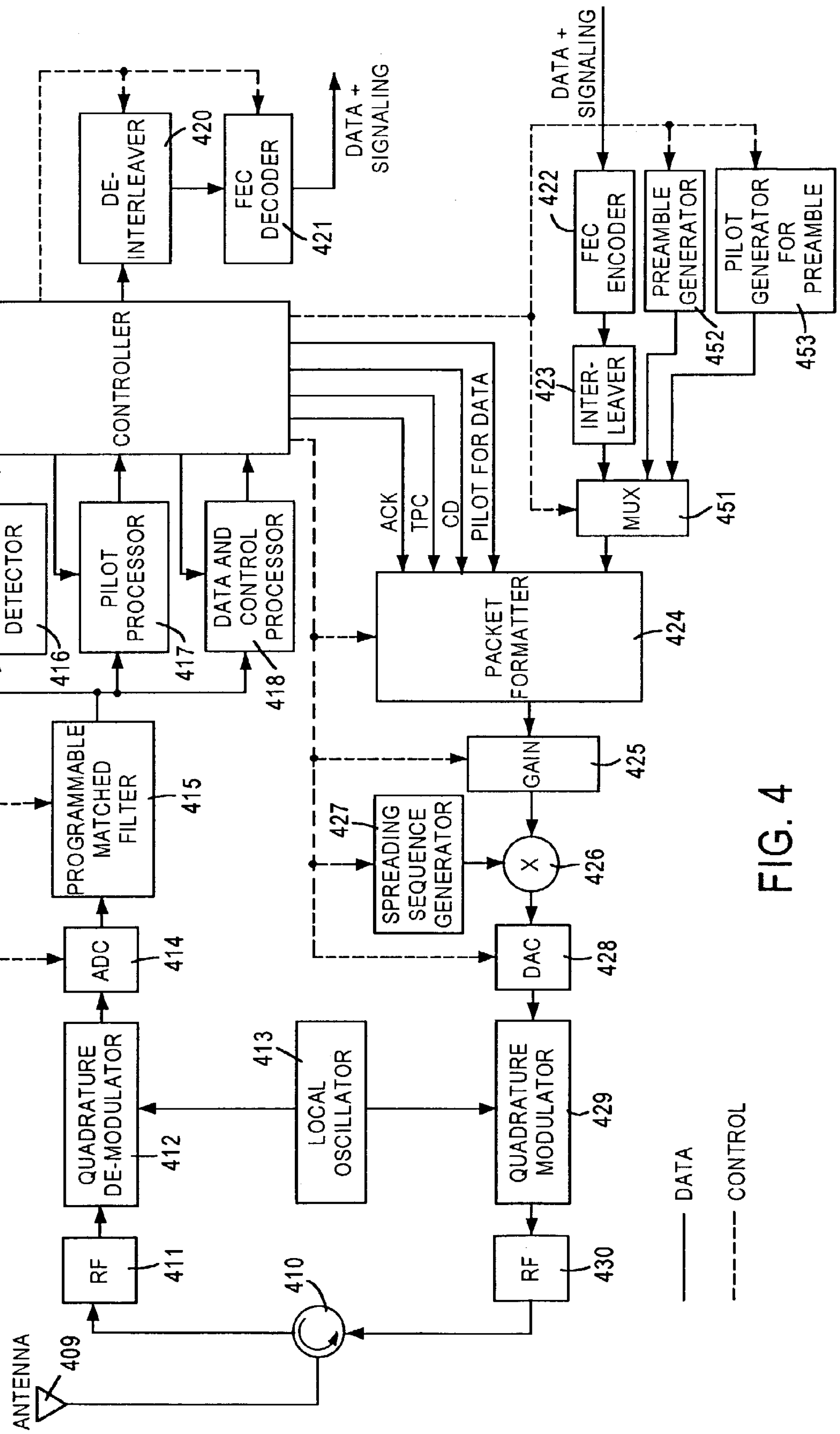
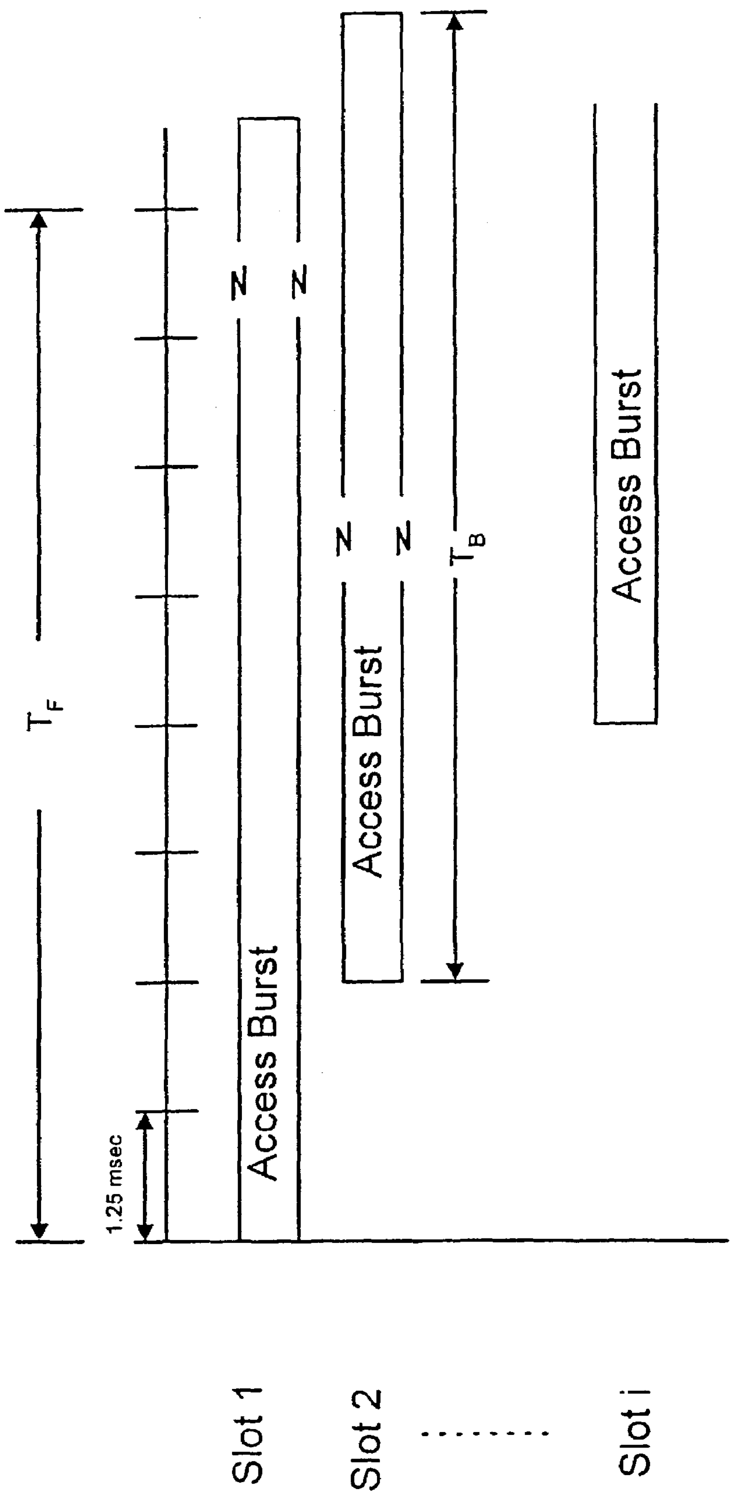
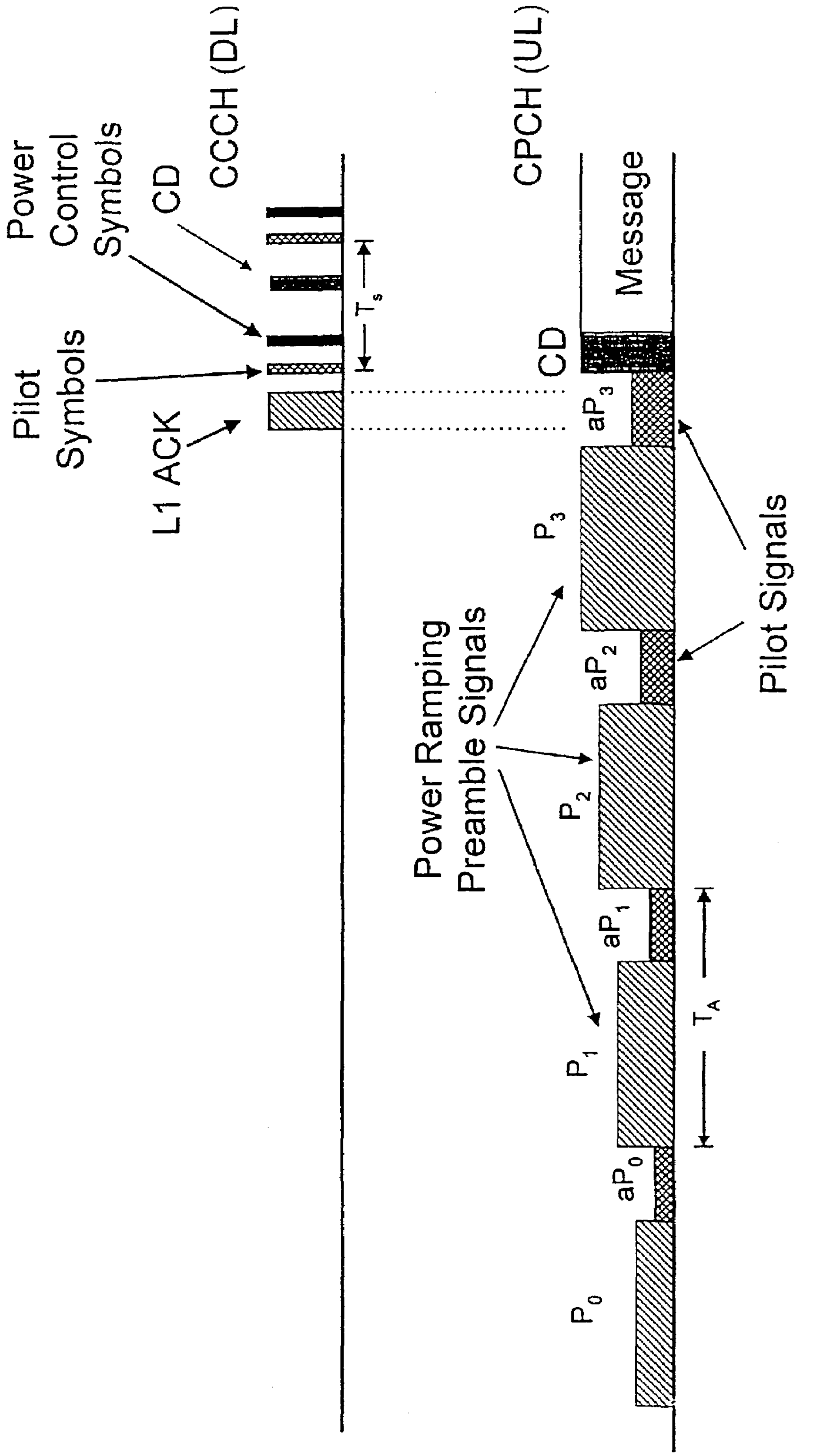

ANTENNA
409
410
RF
411
RF
430
QUADRATURE DE-MODULATOR
412
LOCAL OSCILLATOR
413
QUADRATURE MODULATOR
429
ADC
414
DAC
428
PROGRAMMABLE MATCHED FILTER
415
SPREADING SEQUENCE GENERATOR
427
426
GAIN
425
ACK DETECTOR
416
PILOT PROCESSOR
417
DATA AND CONTROL PROCESSOR
418
PACKET FORMATTER
424
CONTROLLER
419
ACK
TPC
CD
PILOT FOR DATA
MUX
451
DE-INTERLEAVER
420
FEC DECODER
421
DATA + SIGNALING
DATA + SIGNALING
FEC ENCODER
422
INTER-LEAVER
423
PREAMBLE GENERATOR
452
PILOT GENERATOR FOR PREAMBLE
453
DATA
CONTROL

FIG. 4



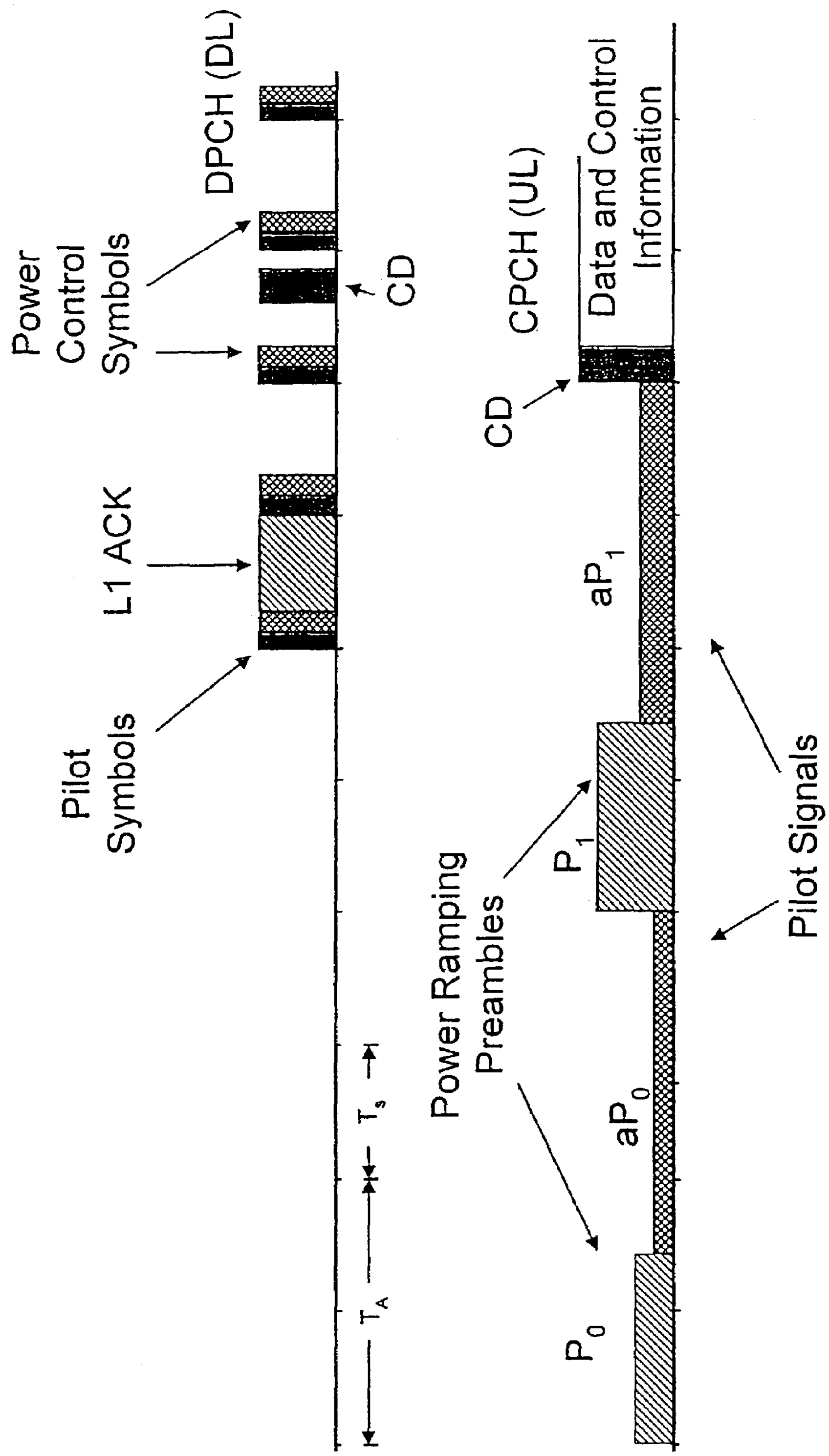
T_F
1.25 msec
Access Burst
Access Burst
T_B
Access Burst
Slot 1
Slot 2
Slot i

FIG. 5



CCCH (DL)
Power Control Symbols
CD
Pilot Symbols
L1 ACK
T_s
CPCH (UL)
Message
CD
aP_3
P_3
aP_2
P_2
aP_1
P_1
aP_0
P_0
T_A
Power Ramping Preamble Signals
Pilot Signals

FIG 6



DPCH (DL)
Power Control Symbols
CD
L1 ACK
Pilot Symbols
T_A
T_s
CPCH (UL)
Data and Control Information
CD
aP_1
P_1
Power Ramping Preambles
Pilot Signals
aP_0
P_0

FIG 7

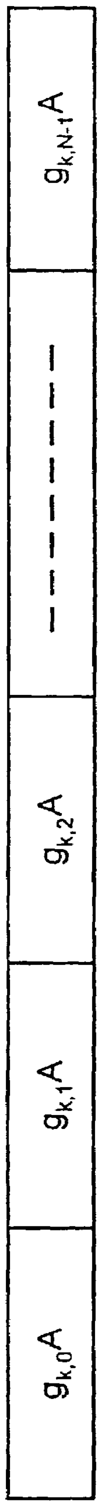
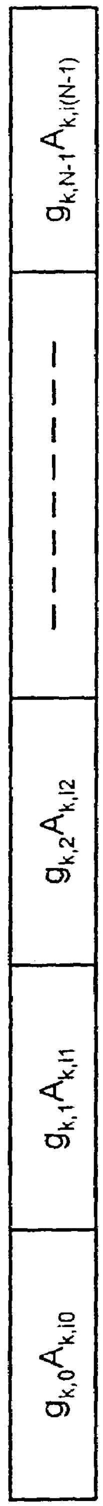


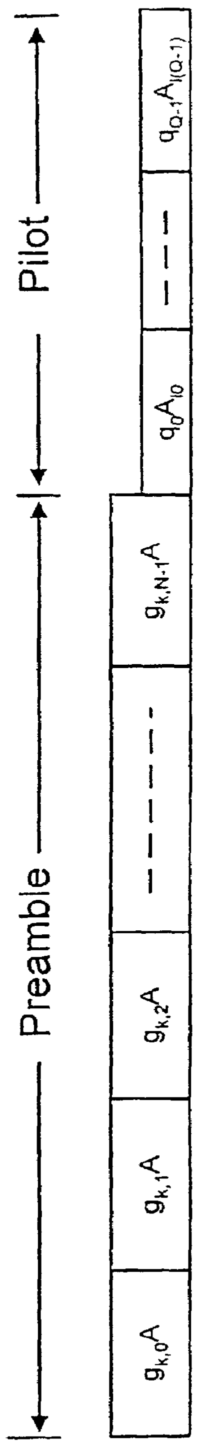
FIG 8(A)



$A_{k,ij} \in [A_0, A_1, A_2, \ldots, A_{N-1}]$

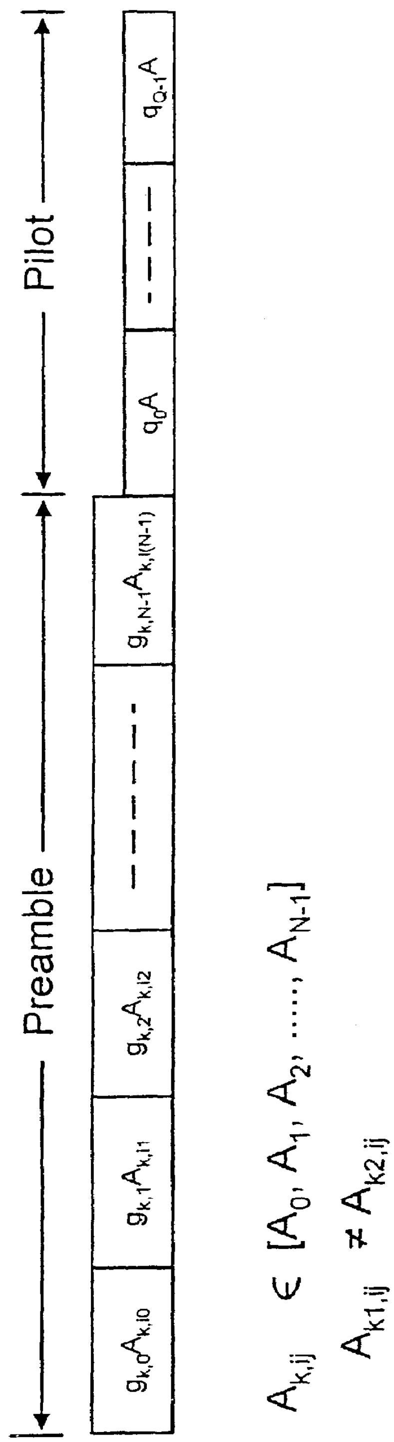
$A_{k1,ij} \neq A_{k2,ij}$

FIG 8(B)



Preamble
Pilot
$g_{k,0}A$
$g_{k,1}A$
$g_{k,2}A$
$g_{k,N-1}A$
q_0A_{l0}
$q_{Q-1}A_{l(Q-1)}$

FIG 9(A)



Preamble
Pilot
$g_{k,0}A_{k,l0}$
$g_{k,1}A_{k,l1}$
$g_{k,2}A_{k,l2}$
$g_{k,N-1}A_{k,l(N-1)}$
q_0A
$q_{Q-1}A$
$A_{k,ij} \in [A_0, A_1, A_2, \ldots, A_{N-1}]$
$A_{k1,ij} \neq A_{k2,ij}$

FIG 9(B)

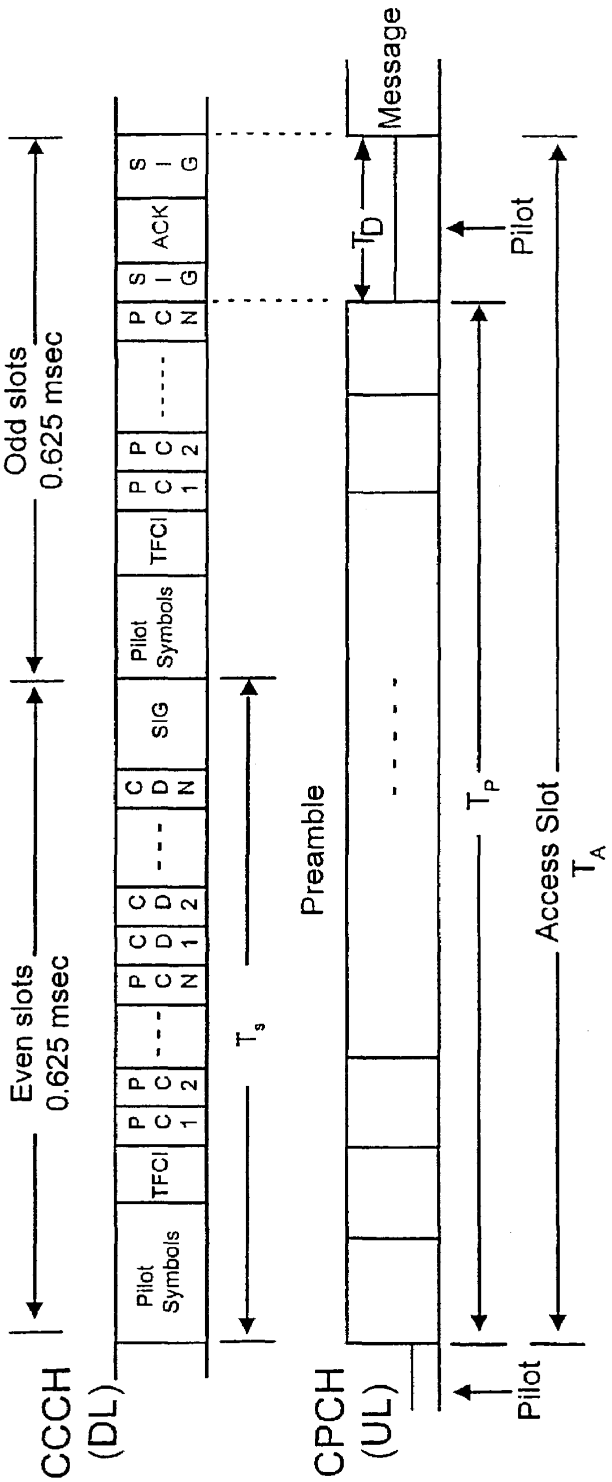

CCCH
(DL)
Even slots
0.625 msec
Odd slots
0.625 msec
Pilot Symbols
TFCI
PC1
PC2
PCN
CD1
CD2
CDN
SIG
ACK
Ts
CPCH
(UL)
Preamble
Message
TD
TP
Pilot
Access Slot
TA

FIG 10

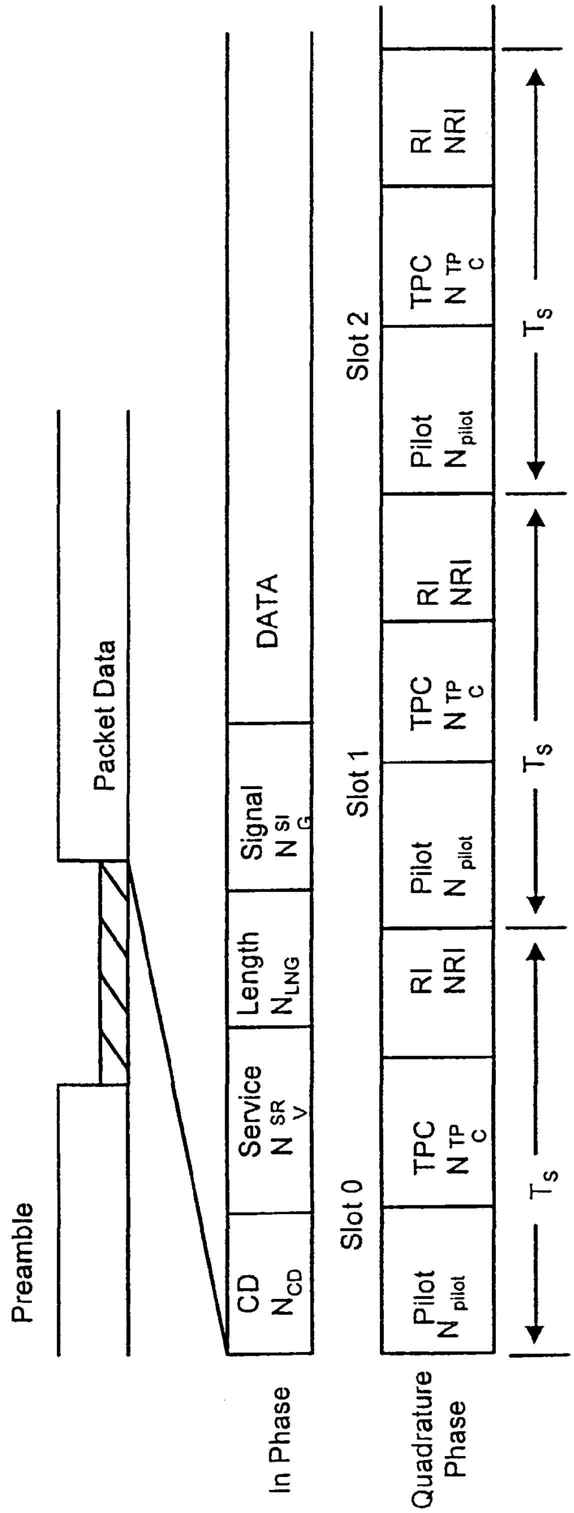

Preamble
Packet Data
In Phase
CD
N_{CD}
Service
N_{SRV}
Length
N_{LNG}
Signal
N_{SIG}
DATA
Quadrature Phase
Slot 0
Slot 1
Slot 2
Pilot
N_{pilot}
TPC
N_{TPC}
RI
NRI
T_S

FIG 11

RACH RAMP-UP ACKNOWLEDGEMENT

This application is a continuation of application Ser. No. 09/273,450 filed Mar. 22, 1999 now U.S. Pat. No. 6,574,267.

BACKGROUND OF THE INVENTION

This invention relates spread-spectrum communications, and more particularly to code-division-multiple-access (CDMA) cellular, collision detection for packet-switched systems.

DESCRIPTION OF THE RELEVANT ART

Presently proposed for a standard is a random-access burst structure which has a preamble followed by a data portion. The preamble has 16 symbols, the preamble sequence, spread by an orthogonal Gold code. A mobile station acquires chip and frame synchronization, but no consideration is given to closed-loop power control or collision detection.

SUMMARY OF THE INVENTION

An objective is to provide random channel access with reliable high data throughput and low delay on CDMA systems.

From a first RS-spread-spectrum transmitter, the steps include transmitting an access-burst signal. The access-burst signal has multiple segments at different power levels, that is to say typically at sequentially increasing power levels a collision.

The BS-spread-spectrum receiver receives at least one segment of the access burst signal at a detectable power level. In response, the BS-spread-spectrum transmitter sends an acknowledgment signal back to the first RS-spread-spectrum receiver. Receipt of the acknowledgment signal by the first RS-spread-spectrum receiver causes the RS-spread-spectrum transmitter to send data to the BS-spread-spectrum receiver. The detection of the segment at an adequate power level, acknowledgment communication and subsequent data transmission provides the remote station (RS) with random access to the channel (RACH).

The preferred embodiment also provides that when there is a collision of a first access-burst signal with a collision access-burst signal, then the BS-spread-spectrum receiver does not correctly receive the collision-detection portion of the first access-burst signal. Thus, the BS-spread-spectrum transmitter transmits to the first RS-spread-spectrum receiver, an collision-detection without reflecting the receiver, in response to receiving the collision-detection signal without the collision detection portion, the first RS-spread-spectrum transmitter transmits to the BS-spread-spectrum receiver, a second access-burst signal.

Additional objects and advantages of the invention are set forth in part in the description which follows, and in part are obvious from the description, or may be learned by practice of the invention. The objects and advantages of the invention also may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate preferred

embodiments of the invention, and together with the description serve to explain the principles of the invention.

FIG. **1** is a common packet channel system block diagram with a common control downlink channel;

FIG. **2** is common packet channel system block diagram with a dedicated downlink channel;

FIG. **3** is a block diagram of a base station receiver for common packet channel;

FIG. **4** is a block diagram of a remote station receiver and transmitter for common packet channel;

FIG. **5** is a timing diagram for access burst transmission;

FIG. **6** illustrates common packet channel access burst of FIG. **5** using a common control downlink channel;

FIG. **7** illustrates common packet channel access of FIG. **5** using a dedicated downlink channel

FIG. **8** shows the structure of the preamble;

FIG. **9** illustrates preamble and pilot formats;

FIG. **10** is a common packet channel timing diagram and frame format of the down link common control link; and

FIG. **11** illustrates frame format of common packet channel, packet data.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference now is made in detail to the present preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals indicate like elements throughout the several views.

The common-packet channel is a new and novel uplink transport channel for transmitting variable size packets from a remote station to a base station within listening range, without the need to obtain a two way link with any one or set of base stations. The channel resource allocation is contention based; that is, a number of mobile stations could at any time content for the same resources, as found in an ALOHA system.

In the exemplary arrangement shown in FIG. **1**, common-packet channel provides an improvement to a code-division-multiple-access (CDMA) system employing spread-spectrum modulation. The CDMA system has a plurality of base stations (BS) **31**, **32**, **33** and a plurality of remote stations (RS). Each remote station **35** has an RS-spread-spectrum transmitter and an RS-spread-spectrum receiver. An uplink is from the remote station **35** to a base station **31**. The uplink has the common-packet channel (CPCH). A downlink is from a base station **31** to the remote station **35**, and is denoted a common-control channel (CCCH). The common-control channel has common signaling used by the plurality of remote stations.

An alternative to the common-control channel, but still using the common-packet channel, is the downlink dedicated physical channel (DPCH), shown in FIG. **2**. The dedicated downlink channel, has signaling that is used for controlling a single remote station.

As illustratively shown in FIG. **3**, a BS spread-spectrum transmitter and a BS spread-spectrum receiver is shown. The BS spread-spectrum transmitter and the BS spread-spectrum receiver are located at the base station **31**. The BS spread-spectrum receiver includes an antenna **309** coupled to a circulator **310**, a receiver radio frequency (RF) section **311**, a local oscillator **313**, a quadrature demodulator **312**, and an analog-to-digital converter **314**. The receiver RF section **311** is coupled between the circulator **310** and the quadrature demodulator **312**. The quadrature demodulator is coupled to the local oscillator **313** and to the analog to digital converter

314. The output of the analog-to-digital converter **315** is coupled to a programmable-matched filter **315**.

A preamble processor **316**, pilot processor **317** and data-and-control processor **318** are coupled to the programmable-matched filter **315**. A controller **319** is coupled to the preamble processor **316**, pilot processor **317** and data-and-control processor **318**. A de-interleaver **320** is coupled between the controller **319** and a forward-error-correction (FEC) decoder **321**.

The BS spread-spectrum transmitter includes a forward-error-correction (FEC) encoder **322** coupled to an interleaver **323**. A packet formatter **324** is coupled to the interleaver **323** and to the controller **319**. A variable gain device **325** is coupled between the packet formatter **324** and a product device **326**. A spreading-sequence generator **327** is coupled to the product device **326**. A digital-to-analog converter **328** is coupled between the product device **328** and quadrature modulator **329**. The quadrature modulator **329** is coupled to the local oscillator **313** and a transmitter RF section **330**. The transmitter RF section **330** is coupled to the circulator **310**.

The controller **319** has control links coupled to the analog-to-digital converter **314**, programmable-matched filter **315**, preamble processor **316**, the digital-to-analog converter **328**, the spreading sequence generator **327**, the variable gain device **325**, the packet formatter **324**, the de-interleaver **320**, the FEC decoder **321**, the interleaver **323** and the FEC encoder **322**.

A received spread-spectrum signal from antenna **309** passes through circulator **310** and is amplified and filtered by receiver RF section **311**. The local oscillator **313** generates a local signal which quadrature demodulator **312** uses to demodulator in-phase and quadrature phase components of the received spread-spectrum signal. The analog-to-digital converter **314** converts the in-phase component and the quadrature-phase component to a digital signal. These functions are well known in the art, and variations to this block diagram can accomplish the same function.

The programmable-matched filter **315** despreads the received spread-spectrum signal. A correlator, as an alternative, may be used as an equivalent means for despeading the received spread-spectrum signal.

The preamble processor **316** detects the preamble portion of the received spread-spectrum signal. The pilot processor detects and synchronizes to the pilot portion of the received spread-spectrum signal. The data and control processor detects and processes the data portion of the received spread-spectrum signal. Detected data passes through the controller **319** to the de-interleaver **320** and FEC decoder **321**. Data and signaling are outputted from the FEC decoder **321**.

In the BS transmitter, data are FEC encoded by FEC encoder **322**, and interleaved by interleaver **323**. The packet formatter formats data, signaling, acknowledgment signal, collision detection signal, pilot signal and transmitting power control (TPC) signal into a packet. The packet is outputted from packet formatter, and the packet level is amplified or attenuated by variable gain device **325**. The packet is spread-spectrum processed by product device **326**, with a spreading chip-sequence from spreading-sequence generator **327**. The packet is converted to an analog signal by digital-to-analog converter **328**, and in-phase and quadrature-phase components are generated by quadrature modulator **329** using a signal from local oscillator **313**. The packet is translated to a carrier frequency, filtered and amplified by transmitter RF section **330**, and then passes through circulator **310** and is radiated by antenna **309**.

In the illustrative embodiment shown in FIG. **4**, a RS spread-spectrum transmitter and a RS spread-spectrum receiver are shown. The RS spread-spectrum transmitter and the RS spread-spectrum receiver are located at the mobile implementation of the remote station **35**, shown as an MS (mobile station) in FIG. **1**. The RS spread-spectrum receiver includes an antenna **409** coupled to a circulator **410**, a receiver radio frequency (RF) section **411**, a local oscillator **413**, a quadrature demodulator **412**, and an analog-to-digital converter **414**. The receiver RF section **411** is coupled between the circulator **410** and the quadrature demodulator **412**. The quadrature demodulator is coupled to the local oscillator **413** and to the analog to digital converter **414**. The output of the analog-to-digital converter **415** is coupled to a programmable-matched filter **415**.

An acknowledgment detector **416**, pilot processor **417** and data-and-control processor **418** are coupled to the programmable-matched filter **415**. A controller **419** is coupled to the acknowledgment detector **416**, pilot processor **417** and data-and-control processor **418**. A de-interleaver **420** is coupled between the controller **419** and a forward-error-correction (FEC) decoder **421**.

The RS spread-spectrum transmitter includes a forward-error-correction (FEC) encoder **422** coupled to an interleaver **423**. A packet formatter **424** is coupled through a multiplexer **451** to the interleaver **423** and to the controller **419**. A preamble generator **452** and a pilot generator **453** for the preamble are coupled to the multiplexer **451**. A variable gain device **425** is coupled between the packet formatter **424** and a product device **426**. A spreading-sequence generator **427** is coupled to the product device **426**. A digital-to-analog converter **428** is coupled between the product device **428** and quadrature modulator **429**. The quadrature modulator **429** is coupled to the local oscillator **413** and a transmitter RF section **430**. The transmitter RF section **430** is coupled to the circulator **410**.

The controller **419** has control links coupled to the analog-to-digital converter **414**, programmable-matched filter **415**, acknowledgment detector **416**, the digital-to-analog converter **428**, the spreading sequence generator **427**, the variable gain device **425**, the packet formatter **424**, the de-interleaver **420**, the FEC decoder **421**, the interleaver **423**, the FEC encoder **422**, the preamble generator **452** and the pilot generator **453**.

A received spread-spectrum signal from antenna **409** passes through circulator **410** and is amplified and filtered by receiver RF section **411**. The local oscillator **413** generates a local signal which quadrature demodulator **412** uses to demodulate in-phase and quadrature phase components of the received spread-spectrum signal. The analog-to-digital converter **414** converts the in-phase component and the quadrature-phase component to a digital signal. These functions are well known in the art, and variations to this block diagram can accomplish the same function.

The programmable-matched filter **415** despreads the received spread-spectrum signal. A correlator, as an alternative, may be used as an equivalent means for despreading the received spread-spectrum signal.

The acknowledgment detector **416** detects an acknowledgment in the received spread-spectrum signal. The pilot processor detects and synchronizes to the pilot portion of the received spread-spectrum signal. The data and control processor detects and processes the data portion of the received spread-spectrum signal. Detected data passes through the controller **419** to the de-interleaver **420** and FEC decoder **421**. Data and signaling are outputted from the FEC decoder **421**.

In the RS transmitter, data are FEC encoded by FEC encoder **422**, and interleaved by interleaver **423**. The preamble generator **452** generates a preamble and the pilot generator **453** generates a pilot for the preamble. The multiplexer **451** multiplexes the data, preamble and pilot, and the packet formatter **424** formats the preamble, pilot and data into a common-packet channel packet. Further, the packet formatter formats data, signaling, acknowledgment signal, collision detection signal, pilot signal and TPC signal into a packet. The packet is outputted from packet formatter, and the packet level is amplified or attenuated by variable gain device **425**. The packet is spread-spectrum processed by product device **426**, with s spreading chip-sequence from spreading-sequence generator **427**. The packet is converted to an analog signal by digital-to-analog converter **428**, and in-phase and quadrature-phase components are generated by quadrature modulator **429** using a signal from local oscillator **413**.

Referring to FIG. **5**, the base station transmits a common-synchronization channel, which has a frame time duration T_F. The common-synchronization channel has a common chip-sequence signal, which is common to the plurality of remote stations communicating with the particular base station. In a particular embodiment, the time T_F of one frame is ten milliseconds. Within one frame, there are eight access slots. Each access slot lasts 1.25 milliseconds. Timing for the access slots is the frame timing, and the portion of the common-synchronization channel with the frame timing is denoted the frame-timing signal. The frame-timing signal is the timing a remote station uses in selecting an access slot in which to transmit an access-burst signal.

A first remote station attempting to access the base station, has a first RS-spread-spectrum receiver for receiving the common synchronization channel, broadcast from the base station. The first RS-spread-spectrum receiver determines frame timing from the frame-timing signal.

A first RS-spread-spectrum transmitter, located at the first remote station, transmits an access-burst signal. An access burst signal, as shown in FIG. **5**, starts at the beginning of an access slot, as defined by the frame timing portion of the common-synchronization channel.

FIG. **6** illustratively shows the common-packet channel access burst format, for each access-burst signal. Each access-burst signal has a plurality of segments. Each segment has a preamble followed by a pilot signal. The plurality of segments has a plurality of power levels, respectively. More particularly, the power level of each segment increases with each subsequent segment. Thus, a first segment has a first preamble and pilot, at a first power level P_0. A second segment has a second preamble and a second pilot, at a second power level P_1. The third segment has a third preamble and a third pilot at a third power level P_2. The first preamble, the second preamble, the third preamble, and subsequent preambles, may be identical or different. The power level of the pilot preferably is less than the power level of the preamble. A preamble is for synchronization, and a corresponding pilot, which follows a preamble, is to keep the BS spread-spectrum receiver receiving the spread-spectrum signal from the remote station, once a preamble is detected.

A subsequent increase or decrease of power levels is basically a closed loop power control system. Once a BS spread-spectrum receiver detects a preamble from the remote station, the BS spread-spectrum transmitter sends an acknowledgment (ACK) signal.

Referring to FIG. **4**, the preamble is generated by preamble generator **452** and the pilot is generated by pilot generator **453**. A preamble format is shown in FIG. **8**. The preamble format with a pilot is shown in FIG. **9**. The multiplexer **451**, with timing from the controller **419**, selects the preamble then a corresponding pilot, for packet formatter **424**. A series of preambles and pilots may be generated and made as part of the packet by packet formatter **424**. The preambles and pilots can have their power level adjusted either in the preamble generator **452** and pilot generator **453**, or by the variable gain device **425**.

The BS spread-spectrum receiver receives the access-burst signal at a detected-power level. More particularly, the access-burst signal has the plurality of preambles at a plurality of power levels, respectively. When a preamble with sufficient power level is detected at the BS spread-spectrum receiver, then an acknowledgment (ACK) signal is transmitted from the BS spread-spectrum transmitter. The ACK signal is shown in FIG. **6**, in response to the fourth preamble having sufficient power for detection by the BS spread-spectrum receiver.

FIG. **3** shows the preamble processor **316** for detecting the preamble and the pilot processor **317** for continuing to receive the packet after detecting the preamble. Upon detecting the preamble, the processor **319** initiates an ACK signal which passes to packet formatter **324** and is radiated by the BS spread-spectrum transmitter.

The first RS-spread-spectrum receiver receives the acknowledgment signal. Upon receiving the ACK signal, the first RS-spread-spectrum transmitter transmits to the BS-spread-spectrum receiver, a spread-spectrum signal having data. The data is shown in FIG. **6**, in time, after the ACK signal. The data may include includes a collision detection (CD) portion of the signal, referred to herein as a collision detection signal, and message.

In response to each packet transmitted from the RS spread-spectrum transmitter, the BS receiver detects the collision detection portion of the data, and retransmits the data field of the collision detection portion of the data to the remote station. FIG. **10** shows the timing diagram for re-transmitting the collision detection field. There are several slots for collision detection retransmission, which can be used for re-transmitting the collision detection field for several remote stations. If the collision detection field were correctly re-transmitted to the remote station, then the remote station knows its packet is successfully received by the base station. If the collision detection field were not correctly re-transmitted by the base station, then the remote station assumes there is a collision with a packet transmitted by another remote station, and stops further transmission of the data.

In operation, an overview of the way this transport mechanism is used is as follows. A remote station (RS) upon power up searches for transmission from nearby base stations. Upon successful synchronization with one or more base stations, the Remote station receives the necessary system parameters from a continuously transmitted by all base stations broadcast control channel (BCCH). Using the information transmitted from the BCCH, the remote station can determine various parameters required when first transmitting to a base station. Parameters of interest are the loading of all the base stations in the vicinity of the remote station, their antenna characteristics, spreading codes used to spread the downlink transmitted information, timing information and other control information. With this information, the remote station can transmit specific waveforms in order to capture the attention of a nearby base station. In the common packet channel the remote station, having all the necessary information from the nearby base station, it starts

transmitting a particular preamble from a set of predefined preambles, at a well selected time intervals. The particular structure of the preamble waveforms is selected on the basis that detection of the preamble waveform at the base station is to be as easy as possible with minimal loss in detectability.

The physical common packet channel (CPCH) is used to carry the CPCH. It is based on the well known Slotted ALOHA approach. There is a number of well defined time offsets relative to the frame boundary of a downlink received BCCH channel. These time offsets define access slots. The number of access slots is chosen according to the particular application at hand. As an example, shown in FIG. **5**, eight access slots are spaced 1.25 msec apart in a frame of 10-msec duration.

According to FIG. **5**, a remote station picks an access slot in a random fashion and tries to obtain a connection with a base station by transmitting a preamble waveform. The base station is able to recognize this preamble, and is expecting its reception at the beginning of each access slot. The length of the access burst is variable and the length of the access burst is allowed to vary from a few access slots to many frame durations. The amount of data transmitted by the remote station could depend on various factors. Some of those are: class capability of the remote station, prioritization, the control information transmitted down by the base station, and various bandwidth management protocols residing and executed at the base station. A field at the beginning of the data portion signifies the length of the data.

The structure of the access burst is shown in FIG. **6**. The access burst starts with a set of preambles of duration T_P whose power is increased in time from preamble to preamble in a step-wise manner. The transmitted power during each preamble is constant. For the duration T_D between preambles the access burst consists of a pilot signal transmitted at a fixed power level ratio relative to the previously transmitted preamble. There is a one to one correspondence between the code structure of the preamble and the pilot signal. The pilot signal could be eliminated by setting it to a zero power level.

The transmission of the preambles ceases if the preamble has been picked up detected by the base station and the base station has responded to the remote station with a layer one acknowledgment L**1** ACK, which the remote station has also successfully received. Alternatively, transmission of the preamble ceases if the remote station has transmitted the maximum allowed number of preambles Mp without acknowledgement. Upon receiving an L**1** ACK the remote station starts transmission of its data. Once the remote station has transmitted more than Mp preambles, it undergoes a forced random back off procedure. This procedure forces the remote station to delay its access burst transmission for a later time. The random back off procedure could be parameterized based on the priority statues of the Remote station. The amount by which the power is increased from preamble to preamble is Dp which is either fixed for all cells at all times or it is repeatedly broadcast via the BCCH. Remote stations with different priority statuses could use a power increase which depends on a priority status assigned to the remote station. The priority status could be either predetermined or assigned to the remote station after negotiation with the base station.

The Preamble Signal Structure

There is a large set of possible preamble waveforms. Every base station is assigned a subset of preambles from the set of all preamble waveforms in the system. The set of preambles a base station is using is broadcast through it's BCCH channel. There are many ways of generating preamble waveforms. One existing way is to use a single orthogonal Gold code per preamble from the set of all possible orthogonal Gold codes of length L. A preamble could then be constructed by repeating the Gold code a number of times N to transmit a length N complex sequence. For example if A denotes the orthogonal Gold code and $G_i=\{g_{i,0}\ g_{i,1}g_{i,2}\ \ldots\ g_{i,N-1}\}$ a length N complex sequence, then a preamble could be formed as shown in FIG. **8**, where, $g_{i,j}$, j=0, . . . , N−1, multiplies every element in A. Normally the sets of G_i's are chosen to be orthogonal to each other. This will allow D for a maximum of N possible waveforms. The total number of possible preambles is then L*N.

The preferred approach is to use different codes rather than a single repeating code in generating each preamble. In that case, if L possible codes, not necessarily Gold Codes, were possible, designated by $A_0, A_1, \ldots A_{L-1}$, then possible preambles will be as shown in FIG. **8**. The order of the A_i's can be chosen so that identical codes are not used in the same locations for two different preambles. A similar approach could be used to form the pilot signals.

The Downlink Common Control Channel

In FIG. **10**, the downlink common control channel structure for even and odd slots is shown. The even slots contain reference data and control data. The pilot symbols are used to derive a reference for demodulating the remaining control symbols. The control symbols are made of transport frame indicator (TFI) symbols, power control (PC) symbols, collision detection (CD) symbol and signaling symbols (SIG). The odd slots contain all the information that the even slots contain plus an acknowledgment (ACK) signal. Odd slots do not include collision detection fields.

The uplink CPCH is shown over the last transmitted preamble. After the last transmitted preamble, the base station has successfully detected the transmission of the last transmitted preamble and transmits back the acknowledgment signal. During the same time, the remote station is tuned to receive the ACK signal. The ACK signal transmitted corresponds to the specific preamble structure transmitted on the uplink. Once the remote station detects the ACK signal corresponding to transmitted preamble by the remote station, the remote station begins transmission of its data.

Corresponding with the preamble structure in the uplink there is a corresponding in time power control information symbol and a corresponding in time collision detection field. Upon start of data transmission the remote station uses the downlink transmitted power control information to adjust its transmitted power. The power control symbols are decoded to derive binary decision data, which is then used to increase or decrease the transmitted power accordingly. FIG. **11** shows the structure of the uplink frame and the slot format for the data portion of the uplink transmission. Data and control information is transmitted in an in-phase and quadrature-phase multiplexed format. That is, the data portion could be transmitted on the in-phase coordinate and the control portion on the quadrature-phase coordinate. The modulation for the data and control is BPSK. The control channel may contain the information for the receiver to enable the demodulation of the data. The control channel provides for upper layer system functionality. The data portion consists of one or more frames. Each frame consists of a number of slots. As an example the frame duration could be 10 milliseconds long and the slot duration 0.625 milliseconds long. In that case, there are 16 slots per frame. The beginning of the data payload contains a collision detection field used to relay information about the possibility of

collision with other simultaneously transmitting remote stations. The collision detection field is read by the base station. The base station expects the presence of the collision detection field since it had provided an ACK signal at the last time slot.

The collision detection field includes a temporary identification (ID) number chosen at random by the mobile for the transmission of the current packet. The base station reads the collision detection field and reflects, or transmits back, the collision detection field on the downlink. If the collision detection field detected by the remote station matched the one just being transmitted by the same remote station, then the collision detection field is an identification that the transmission is being received correctly. The remote station then continues transmitting the remaining of the packet. In case the collision detection field has not been received correctly by the remote station, then the remote station considers the packet reception by the base station as erroneous and discontinues transmission of the remaining packet.

The function of the remaining fields are as follows. The Pilot field enables the demodulation of both the data and control bits. The transmitted power control (TPC) bits are used to control the power of a corresponding downlink channel, in case a down link channel directed to the same user is operational. If the downlink channel were not operational, then the TPC control bits can be used to relay additional pilot bits instead.

The Rate Information (RI) field is used to provide the transmitter with the ability to change its data rate without the necessity to explicitly negotiate the instantaneous data rate with the base station. The service field provides information of the particular service the data bits are to be used for. The length field specifies the time duration of the packet. The signal field can be used to provide additional control information as required.

Additional functionalities of the common packet channel are: (1) bandwidth management and (2) L**2** acknowledgment mechanism.

The bandwidth management functionality is implemented via signaling information on the down link common control channel. There are three ways for incorporating this functionality. The first relies on changing the priority status of all uplink users, which currently are transmitting information using the CPCH. By this method all the users are remapping their priority status via a control signal sent at the downlink. When the priority of the CPCH users is lowered their ability to capture an uplink channel is lowered. Thus the amount of data sent on the uplink by the CPCH users is thus reduced. The other mechanism is for the base station to relay the maximum possible data rate the CPCH users are allowed to transmit. This prevents the CPCH users from transmitting at a rate which could possibly exceed the uplink system capacity and therefore take the cell down, i.e., disrupt the communication for all users currently connected to the base station. For the third method, the base station could provide a negative acknowledgment through the ACK signal. In this case, any remote station which is tuned to receive the ACK signal is prohibited from further transmission of an access-burst signal.

The L**2** acknowledgment (L**2** ACK) mechanism, which is different than the L**1** ACK, is used by the base station to notify the remote station for the correctness of an uplink packet reception. The base station could either relay to the remote station which portions of the packet have being received correctly or which have being received incorrectly. There are many existing ways of implementing a particular protocol to relay this type of information. For example, the packet could be identified as consisting of a number of frames, with each frame consisting of a number of sub-frames. The frames are identified by a predetermined number. The sub-frames in each frame are also identified by a specific number. One way for the base to relay the information about the correctness of the packet is to identify all the frames and sub-frames that have been received correctly. Another way is to identify the frames and sub-frames that have been received in error. The way the base station could identify the correctness of a frame or sub-frame is by checking its cyclic residue code (CRC) field. Other more robust mechanisms for acknowledgment may be used.

CD Operation

There are many remote stations that might try to access the base station at the same time. There is a number of different preamble signals which a remote station can use for reaching the base station. Each remote station chooses at random one of the preamble signals to use for accessing the base station. The base station transmits a broadcast common synchronization channel. This broadcast common synchronization channel includes a frame timing signal. The remote stations extract the frame timing transmitted by the base station by receiving the broadcast common synchronization channel. The frame timing is used by the remote stations to derive a timing schedule by dividing the frame duration in a number of access slots. The remote stations are allowed to transmit their preambles only at the beginning of each access slot. The actual transmit times for different remote stations could be slightly different due to their different propagation delays. This defines an access protocol commonly known as the slotted ALOHA access protocol. Each remote station repeatedly transmits its preamble signal until the base station detects the preamble, acknowledges that the preamble is received, and the acknowledgment is correctly received by the remote station. There could be more than one remote station transmitting the same preamble signal in the same access slot. The base station cannot recognize if two or more remote stations were transmitting the same preamble in the same access slot. When the base station detects the transmission of a preamble signal, it transmits back an acknowledgment message. There is one acknowledgment message corresponding to each possible preamble signal. Therefore, the are as many acknowledgment messages as there are preamble signals. Every transmitting remote station which receives an acknowledgment message corresponding to its transmitting preamble signal, will start transmitting its message. For each preamble signal, there is a corresponding spreading code used by the base station to transmit the message. The message transmission always starts at the beginning of an access slot. Since there could be a number of remote stations using the same preamble signal in the same access slot, they start transmitting their message at the same time using the same spreading code. In that case, the transmissions of the remote stations likely interferes with each other and thus is not received correctly.

Each remote station includes a collision detection (CD) field in the beginning of the transmitted message. The CD field is chosen at random by each remote station and independently from each other Remote Station. There is a predefined limited number of CD fields. Two remote stations transmitting their message at the same time most likely chose a different CD field. When the base station receives the CD field, the base station reflects back, transmits back, the CD field to the remote station. The remote station reads the reflected CD field by the base station. If the reflected CD

field matched the the CD field the remote station transmitted, the the remote station assumes that the remote station is being received correctly by the base station and continue transmitting the rest of the message, or data. If the reflected CD field from the base station did not match the one transmitted by the remote station, then the remote station assumes that there has been a collision and stops transmitting the remaining message or data.

It will be apparent to those skilled in the art that various modifications can be made to the collision detection systems of the instant invention without departing from the scope or spirit of the invention, and it is intended that the present invention cover modifications and variations of the collision detection system provided they come within the scope of the appended claims and their equivalents.

We claim:

1. A method of sending packet data from a remote station, the method comprising:

receiving a broadcast common channel from a base station;

determining at least one parameter required for transmission to the base station from the received broadcast common channel;

transmitting an access-burst signal, the access-burst signal comprising a plurality of segments, each segment comprising a selected access preamble and a pilot signal, the preambles having sequentially increasing discrete power levels;

if the number of transmitted access preambles has reached a maximum allowed number of preambles Mp without detecting an acknowledgement comprising a signal corresponding to a transmitted access preamble, ceasing preamble transmission; and

upon detecting an acknowledgment comprising a signal corresponding to a transmitted access preamble, ceasing preamble transmission, and spread-spectrum transmitting the packet data from the remote station.

2. The method as in claim **1**, wherein power level of the pilot signal is set to a zero power level.

3. The method as in claim **1**, wherein the pilot signals of the plurality of segments of the access-burst signal have sequentially increasing descrete power levels.

4. The method as in claim **1**, wherein the step of determining at least one parameter comprises determining timing of the transmission of at least one of the access preambles.

5. A method as in claim **1**, wherein the determining step comprises choosing the selected preamble from among a set of predefined preambles associated with a base station.

6. The method of claim **1**, wherein the acknowledgement is a level **1** acknowledgement.

7. The method of claim **1**, wherein the power level of the pilot signal is less than the power level of the preamble.

8. A method of sending packet data from a remote station, the method comprising:

receiving a broadcast common channel from a base station;

determining at least one parameter required for transmission to the base station from the received broadcast common channel, comprising determining timing of the transmission of at least one of the access preambles by randomly choosing one of a plurality of time slots defined in relation to the received broadcast common channel to start the transmitting of the access burst signal;

transmitting an access-burst signal, the access-burst signal comprising a plurality of segments having a plurality of constant power levels, each segment comprising a selected access preamble and a pilot signal;

if the number of transmitted access preambles has reached a maximum allowed number of preambles Mp without detecting an acknowledgement comprising a signal corresponding to a transmitted access preamble, ceasing preamble transmission; and

upon detecting an acknowledgement comprising a signal corresponding to a transmitted access preamble, ceasing preamble transmission, and spread-spectrum transmitting the packet data from the remote station.

9. A remote station for wireless communication with a base station of a network, the remote station comprising:

a spread-spectrum transmitter;

a spread-spectrum receiver; and

a controller coupled to the receiver for responding to signals received via the receiver and coupled for controlling the transmitter, such that in operation the remote station is for performing the following steps:

(a) transmitting an access-burst signal, the access-burst signal comprising a plurality of segments having sequentially increasing discrete power levels, each segment comprising a selected access preamble;

(b) if the number of transmitted access preambles has reached a maximum allowed number of preambles Mp without detecting an acknowledgement comprising a signal corresponding to a transmitted access preamble, ceasing preamble transmission; and

(c) upon detecting an acknowledgement comprising a signal corresponding to a transmitted access preamble, ceasing preamble transmission, and spread-spectrum transmitting the packet data from the remote station,

wherein the spread-spectrum transmitter comprises:

(1) a spreading sequence generator;

(2) a product device coupled to an output of the spreading sequence generator and coupled to receive an access preamble and the packet data; and

(3) a digital analog converter responsive to an output of the product device.

10. A remote station for wireless communication with a base station of a network, the remote station comprising:

a spread-spectrum transmitter;

a spread-spectrum receiver; and

a controller coupled to the receiver for responding to signals received via the receiver and coupled for controlling the transmitter, such that in operation the remote station is for performing the following steps:

(a) transmitting an access-burst signal, the access-burst signal comprising a plurality of segments having sequentially increasing discrete power levels, each segment comprising a selected access preamble;

(b) if the number of transmitted access preambles has reached a maximum allowed number of preambles Mp without detecting an acknowledgement comprising a signal corresponding to a transmitted access preamble, ceasing preamble transmission; and

(c) upon detecting an acknowledgement comprising a signal corresponding to a transmitted access preamble, ceasing preamble transmission, an spread-spectrum transmitting the packet data from the remote station,

wherein the spread-spectrum receiver comprises:

(1) an analog to digital converter responsive to a signal received by the remote station; and

(2) a programmable matched filter responsive to an output of the analog to digital converter.

11. A base-band processor for use in a wireless remote station for communication of data, the remote station having a spread-spectrum modulator and a spread-spectrum demodulator, the base-band processor comprising:

an acknowledgment detector, coupled to the demodulator, for detecting an acknowledgment in a received spread-spectrum signal;

a preamble generator for generating access preamble signals;

a multiplexer for multiplexing the data and the access preamble signals and supplying the multiplexed data and access preamble signals to the modulator for transmission; and

a controller coupled to the acknowledgment detector and coupled for controlling the modulator, the preamble generator and the multiplexer, such that in operation the remote station performs the following steps:

(a) spreading an access preamble selected from a set of predefined preamble, associated with the base station;

(b) transmitting from the remote station an access-burst signal, the access-burst signal comprising a plurality of segments having sequentially increasing discrete power levels, each segment comprising the spread selected access preamble;

(c) if the number of transmitted access preambles has reached a maximum allowed number of preambles Mp without detecting an acknowledgement comprising a signal corresponding to the transmitted access preamble, ceasing preamble transmission; and

(d) upon detecting an acknowledgement comprising a signal corresponding to the transmitted access preamble, ceasing preamble transmission, and spread-spectrum transmitting the packet data from the remote station.

12. The base-band processor as in claim **11**, further comprising:

an encoder, for encoding data; and

an interleaver, coupled to the encoder, for interleaving encoded data and supplying the interleaved data to the multiplexer for multiplexing with the access preamble signals.

13. A base-band processor for use in a wireless remote station for communication of data, the remote station having a spread-spectrum modulator and a spread-spectrum demodulator, the base-band processor comprising:

an acknowledgement detector, coupled to the demodulator, for detecting an acknowledgment in a received spread-spectrum signal;

a preamble generator for generating access preamble signals;

a multiplexer for multiplexing the data and the access preamble signals and supplying the multiplexed data and access preamble signals to the modulator for transmission;

an encoder, for encoding data;

an interleaver, coupled to the encoder, for interleaving encoded data and supplying the interleaved data to the multiplexer for multiplexing with the access preamble signals;

a packet formatter, coupled to the multiplexer, for formatting the multiplexed data and access preamble signals into one or more packets and supplying the one or more packets to the modulator; and

a controller coupled to the acknowledgement detector and coupled for controlling the modulator, the preamble generator and the multiplexer, such that in operation the remote station performs the following steps:

(a) spreading an access preamble selected from a set of predefined preambles associated with the base station;

(b) transmitting from the remote station an access-burst signal, the access-burst signal comprising a plurality of segments having a plurality of constant power levels, each segment comprising the spread selected access preamble;

(c) if the number of transmitted access preambles has reached a maximum allowed number of preambles Mp without detecting an acknowledgement comprising a signal corresponding to the transmitted access preamble, ceasing preamble transmission; and

(d) upon detecting an acknowledgement comprising a signal corresponding to the transmitted access preamble, ceasing preamble transmission, and spread-spectrum transmitting the packet data from the remote station.

14. A method of sending data from a remote station to at least one of a plurality of base stations in a spread-spectrum wireless communication network, comprising:

receiving from a first base station, a first broadcast common-synchronization channel having a first common chip-sequence signal common to a plurality of remote stations;

receiving from a second base station, a second broadcast common-synchronization channel having a second common chip-sequence signal common to a plurality of remote stations;

determining to transmit to the first base station, based on any of power levels and probabilities of error, from the first and second broadcast common-synchronization channels;

transmitting a first access-burst signal to the first base station, the first access-burst signal comprising a plurality of segments having sequentially increasing discrete power levels, each segment comprising an access preamble;

if the number of transmitted access preambles has reached a maximum allowed number of preambles Mp without detecting an acknowledgement signal, ceasing access-burst transmission; and

upon receiving and detecting a first acknowledgment signal corresponding to a transmitted access preamble, from the first base station, ceasing access-burst transmission and transmitting a first spread-spectrum signal having data to the first base station.

15. The method as in claim **14**, wherein the plurality of segments of the first access-burst signal have sequentially increasing discrete power levels.

16. The system as in claim **15**, wherein:

the first access burst signal comprises a preamble code selected from among a plurality of preamble codes allocated to the first base station;

the step of transmitting the first access-burst signal comprises spreading the selected preamble code; and

the first acknowledgment signal corresponds to the selected preamble code.

17. The method as in claim **14**, further comprising receiving data or power control information from the first base station.

18. The method as in claim **14**, further comprising:

determining to transmit to the second base station, based on any of power levels and probabilities of error, front the first and second broadcast common-synchronization channels;

transmitting a second access-burst signal to the second base station, the second access-burst signal comprising a plurality of segments having sequentially increasing discrete power levels, each segment comprising an access preamble;

if the number of transmissions of an access preamble to the second base station has reached a maximum allowed number of preambles Mp without detecting an acknowledgement signal, ceasing access-burst transmission; and

upon receiving and detecting a second acknowledgement signal from the second base station, the second acknowledgment signal corresponding to the an access preamble transmitted to the second base station, ceasing access-burst transmission and transmitting a second spread-spectrum signal having data to the second base station.

19. The method as in claim **18**, wherein the plurality of segments at the second access burst signal have sequentially increasing discrete power levels.

20. The method as in claim **18**, wherein:

the second access burst signal comprises a preamble code selected from among a plurality of preamble codes allocated to the second base station;

the step of transmitting the second access-burst signal comprises spreading the preamble code selected from among the preamble codes allocated to the second base station; and

the second acknowledgment signal corresponds to the preamble code selected from among the preamble codes allocated to the second base station.

21. The method as in claim **18**, further comprising receiving data or power control information from the second base station.

22. The method of claim **18**, wherein the acknowledgement is a level **1** acknowledgement.

23. The method fo claim **18**, wherein the power level of the pilot signal is less than the power level of the preamble.

24. The method of claim **14**, wherein the acknowledgement is a level **1** acknowledgement.

25. The method of claim **14**, wherein the power level of the pilot signal is less than the power level of the preamble.

26. A remote station for wireless communication with a base station of a network, the remote station comprising:

a spread-spectrum transmitter;

a spread-spectrum receiver; and

a controller coupled to the receiver for responding to signals received via the receiver and coupled for controlling the transmitter, such that in operation the remote station is for performing the following steps:

(a) receiving from a first base station, a first broadcast common-synchronization channel having a first common chip-sequence signal common to a plurality of remote stations;

(b) receiving from a second base station, a second broadcast common-synchronization channel having a second common chip-sequence signal common to a plurality of remote stations;

(c) determining to transmit to the first base station, based on any of power levels and probabilities of error, front the first and second broadcast common-synchronization channels;

(d) transmitting an access-burst signal to the first base station comprising a plurality of segments with sequentially increasing discrete power levels, each segment comprising an access preamble;

(e) if the number of transmitted access preambles has reached a maximum allowed number of preambles Mp without detecting an acknowledgement signal, ceasing access-burst signal transmission; and

(f) upon receiving and detecting an acknowledgment signal corresponding to a transmitted access preamble, from the first base station, ceasing transmission of the access-burst signal and transmitting a first spread-spectrum signal having data to the first base station.

27. The remote station as in claim **26**, wherein the spread-spectrum transmitter comprises:

a spreading sequence generator;

a product device coupled to an output of the spreading sequence generator and coupled to receive an access preamble and the packet data; and

a digital to analog convener responsive to an output of the product device.

28. The remote station as in claim **26**, wherein the spread-spectrum receiver comprises:

an analog to digital converter responsive to a signal received by the remote station; and

a programmable matched filter responsive to an output of the analog in digital converter.

29. A base-band processor, for use in a wireless remote station for communication of data, the remote station having a spread-spectrum modulator and a spread-spectrum demodulator, the base-band processor comprising:

an acknowledgment detector, coupled to the demodulator, for detecting an acknowledgement in a received spread-spectrum signal;

a preamble generator for generating access preamble signals;

a multiplexer for multiplexing the data and the access preamble signals and supplying the multiplexed data and access preamble signals to the modulator for transmission; and

a controller coupled to the acknowledgment detector and coupled for controlling the modulator, the preamble generator and the multiplexer, such that in operation the remote station performs the following steps:

(a) receiving from a first base station, a first broadcast common-synchronization channel having a first common chip-sequence signal common to a plurality of remote stations;

(b) receiving from a second base station, a second broadcast common-synchronization channel having a second common chip-sequence signal common to a plurality of remote stations;

(c) determining to transmit to the first base station, based on any of power levels and probabilities of error, from the first and second broadcast common-synchronization channels;

(d) transmitting an access-burst signal to the first base station comprising a plurality of segments with sequentially increasing discrete power levels, each segment comprising an access preamble;

(e) if the number of transmitted access preambles has reached a maximum allowed number of preambles Mp without detecting an acknowledgement signal, ceasing access-burst signal transmission; and

(f) upon receiving and detecting an acknowledgement signal corresponding to a transmitted access pre-

amble, from the first base station, ceasing transmission of the access-burst signal and transmitting a spread-spectrum signal having data to the first base station.

30. The base-band processor as in claim **29**, further comprising:

an encoder, for encoding data; and

an interleaver, coupled to the encoder, for interleaving encoded data and supplying the interleaved data to the multiplexer for multiplexing with the access preamble signals.

31. A base-band processor, for use in a wireless remote station for communication of data, the remote station having a spread-spectrum modulator and a spread-spectrum demodulator, the base-band processor comprising:

an acknowledgement detector, coupled to the demodulator, for detecting an acknowledgement in a received spread-spectrum signal;

a preamble generator for generating access preamble signals;

a multiplexer for multiplexing the data and the access preamble signals and supplying the multiplexed data and access preamble signals to the modulator for transmission;

an encoder, for encoding data;

an interleaver, coupled to the encoder, for interleaving encoded data and supplying the interleaved data to the multiplexer for multiplexing with the access preamble signals;

a packet formatter, coupled to the multiplexer, for formatting the multiplexed data and access preamble signals into one or more packets and supplying the one or more packets to the modulator; and

a controller coupled to the acknowledgement detector and coupled for controlling the modulator, the preamble generator and the multiplexer, such that in operation the remote station performs the following steps:

(a) receiving from a first base station, a first broadcast common-synchronization channel having a first common chip-sequence signal common to a plurality of remote stations;

(b) receiving from a second base station, a second broadcast common-synchronization channel having a second common chip-sequence signal common to a plurality of remote stations;

(c) determining to transmit to the first base station, based on any of power levels and probabilities of error, from the first and second broadcast common-synchronization channels;

(d) transmitting an access-burst signal to the first base station comprising a plurality of segments with a plurality of constant power levels, each segment comprising an access preamble;

(e) if the number of transmitted access preambles has reached a maximum allowed number of preambles Mp without detecting an acknowledgement signal, ceasing access-burst signal transmission; and

(f) upon receiving and detecting an acknowledgement signal corresponding to a transmitted access preamble, from the first base station, ceasing transmission of the access-burst signal and transmitting a spread-spectrum signal having data to the first base station, a packet formatter, coupled to the multiplexer, for formatting the multiplexed data and access preamble signals into one or more packets and supplying the one or more packets to the modulator.

32. A method of sending data from a remote station to at least one of a plurality of base stations in a spread-spectrum wireless communication network, comprising:

receiving from a first base station, a first broadcast common-synchronization channel having a first common chip-sequence signal common to a plurality of remote stations, the first broadcast common-synchronization channel having a first frame-timing signal;

receiving from a second base station, a second broadcast common-synchronization channel having a second common chip-sequence signal common to a plurality of remote stations, the second broadcast common-synchronization channel having a second frame-timing signal;

determining to transmit to the first base station, based on at least one parameter of the received first and second broadcast common-synchronization channels;

spreading an access preamble selected from a set of predefined preambles associated with the first base station;

transmitting an access-burst signal, the access-burst signal having a plurality of segments, each segment comprising a selected access preamble and a pilot signal, the preamble having a sequentially increasing discrete power levels;

if the number of transmissions of the access preamble has reached a maximum allowed number of preambles Mp without detecting an acknowledgement comprising a signal corresponding to the transmitted access preamble, ceasing preamble transmission; and

upon detecting an acknowledgement corresponding to the transmitted access preamble, ceasing preamble transmission and transmitting a first spread-spectrum signal having data, to the first base station.

33. The method as in claim **32**, further comprising:

determining to transmit to the second base station, based on any of power levels and probabilities of error, from the first and second broadcast common-synchronization channels;

spreading another access preamble selected from a set of predefined preambles associated with the second base station;

transmitting an access-burst signal, the access-burst signal having a plurality of segments having sequentially increasing discrete power levels, each segment comprising the spread selected access preamble of the second base station and a pilot signal;

if the number of transmissions of the access preamble of the second base station has reached a maximum allowed number of reached a maximum allowed number of preambles Mp without detecting an acknowledgement comprising signal corresponding to the transmitted access preamble of the second base station, ceasing preamble transmission; and

upon detecting an acknowledgement corresponding to the transmitted access preamble of the second base station, ceasing preamble transmission and transmitting a second spread-spectrum signal having data, to the second base station.

34. The method of claim **33**, wherein the acknowledgement is a level **1** acknowledgement.

35. the method of claim **33**, wherein the power level of the pilot signal is less than the power level of the preamble.

36. A method of sending data from a remote station to at least one of a plurality of base stations in a spread-spectrum wireless communication network, comprising:

receiving from a first base station, a first broadcast common-synchronization channel having a first common chip-sequence signal common to a plurality of remote stations;

receiving from a second base station, a second broadcast common-synchronization channel having a second common chip-sequence signal common to a plurality of remote stations;

determining to transmit to the first base station, based on any of power levels and probabilities of error, from the first and second broadcast common-synchronization channels;

transmitting a first access-burst signal to the first base station, the first access-burst signal comprising a plurality of segments having a plurality of constant power levels, each segment comprising an access preamble and a pilot signal, wherein the power level of each segment is greater than zero;

receiving and detecting a first acknowledgement signal from the first base station corresponding to a transmitted access preamble;

ceasing access-burst transmission; and

transmitting a first spread-spectrum signal having data to the first base station.

37. A method of sending data from a remote station to at least one of a plurality of base stations in a spread-spectrum wireless communication network, comprising:

receiving from a first base station, a first broadcast common-synchronization channel having a first common chip-sequence signal common to a plurality of remote stations, the first broadcast common-synchronization channel having a first frame-timing signal;

receiving from a second base station, a second broadcast common-synchronization channel having a second common chip-sequence signal common to a plurality of remote stations, the second broadcast common-synchronization channel having a second frame-timing signal;

determining to transmit to the first base station, based on at least one parameter of the received first and second broadcast common-synchronization channels;

spreading an access preamble selected from a set of predefined preambles associated with the first base station;

transmitting an access-burst signal, the access-burst signal having a plurality of segments having a plurality of constant power levels, each segment comprising the spread selected access preamble and a pilot signal, wherein the power level of each segment is greater than zero;

detecting an acknowledgement from the first base station, the acknowledgement corresponding to the transmitted access preamble;

ceasing preamble transmission; and

transmitting a first spread-spectrum signal having data, to the first base station.

38. The method as in claim **37**, further comprising:

determining to transmit to the second base station, based on any of power levels and probabilities of error, from the first and second broadcast common-synchronization channels;

spreading another access preamble selected from a set of predefined preambles associated with the second base station;

transmitting an access-burst signal, the access-burst signal having a plurality of segments having a plurality of constant power levels, each segment comprising the spread selected access preamble of the second base station and a pilot signal, wherein the power level of each segment is greater than zero;

detecting an acknowledgement from the second base station, the acknowledgement corresponding to the transmitted access preamble;

ceasing preamble transmission; and

transmitting a second spread-spectrum signal having data, to the second base station.

* * * * *

CERTIFICATE OF SERVICE

I hereby certify, that on September 20, 2013, a true and correct copy of the Corrected Principal Brief of Plaintiff-Appellant Golden Bridge Technology, Inc. was caused to be served on the below-listed counsel by CM/ECF and electronic mail (by agreement of counsel):

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CERTIFICATE OF COMPLIANCE

1. This brief complies with the type-volume limitation of Federal Rule of Appellate Procedure 32(a)(7)(B). The brief contains 13,773 words, excluding the parts of the brief exempted by Federal Rule of Appellate Procedure 32(a)(7)(B)(iii).

2. This brief complies with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and the type style requirements of Federal Rule of Appellate Procedure 32(a)(6). The brief has been prepared in a proportionally spaced typeface using MS Word in a 14 point Times New Roman font.

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